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A DIVISION OF ICF TECHNOLOGY INCORPORATED

PUBLIC COMMENT
FEASIBILITY STUDY REPORT
OPERABLE UNIT NO. 1
LANDFILL WASTE, SOIL, AND SURFACE WATER
VOLUME 1 OF 1

DORNEY ROAD LANDFILL

LEHIGH COUNTY, PENNSYLVANIA

AUGUST 11, 1988

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TABLE OF CONTENTS

ORIGINAL (Red)

LIST OF TABLES

ORIGINAL
(Red)

LIST OF FIGURES

(Rev)

EXECUTIVE SUMMARY

INTRODUCTION

The methodology used in this Feasibility Study report allows a step-by-step evaluation of technologies, alternatives and assembled alternatives by progressing through a series of screenings and evaluations. Initially, general qualitative information is used. Subsequently, more refined and quantitative information is used to eliminate from consideration infeasible or otherwise unacceptable actions. This methodology provides a systematic procedure for identifying and evaluating alternatives, specifying criteria for determining the magnitude and importance of effects resulting from the implementation of an action, and considering measures to mitigate adverse effects.

SITE DESCRIPTION AND BACKGROUND

The Dorney Road Landfill Site (Oswald's Landfill) is located in Upper Macungie Township in Lehigh County, Pennsylvania, approximately eight miles southwest of Allentown. The landfill lies one mile southwest of Breinigsville and 1.4 miles north-northwest of Mertztown. The landfill site covers approximately 27 acres of documented landfill area which is bounded to the east by Dorney Road and extends westward such that the southwest corner of the site is in Longswamp Township, Berks County. Prior to the landfilling activities beginning 1966, the site was operated as an open pit iron mine. The actual date of the mining operation is unknown. The major portion of the Dorney Road Site consists of a municipal landfill surrounded by a perimeter soil berm. Access to the site along Dorney Road is limited by a snow fence which was constructed by the USEPA during a 1986 removal action.

The majority of the site is owned by Emory Mabry of Mertztown, Pennsylvania. A portion of the westernmost protrusion formerly owned by the Mertz estate is currently owned by Robert Tercha. Other surrounding land owners include Kelloggs and Wessners. The general layout of the site and surrounding area is shown on Figure E-1.

On January 1, 1983 and again in April, 1983, the Annapolis Field Office of the USEPA performed an NPL listing inspection. Hazard Ranking System (HRS) scoring for the site was performed by NUS Corporation and was issued on May 23, 1983. The site scored a 46.10; primarily due to groundwater and dermal contact concerns.

Only one remedial action has been reported to have been performed at the site. From June 11 to June 20, 1986 an emergency removal action was performed by the USEPA Emergency Response Contractors (ERCs). The work was performed by O. H. Materials with the general objective to regrade the site to collect and contain on-site surface runoff. The construction of on-site ponds allowed for controlled discharge of surface runoff via two major spillways.

SUMMARY OF PHASED RI ACTIVITIES

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The field activities performed during the Dorney Road RI were conducted in two phases. The Phase II scope of work was developed for the collection of information to fill additional data needs identified during the Phase I RI drilling and well installation activities. Phase II was performed immediately following the Phase I RI.

During the Phase I RI, the following major activities were performed:

Ambient Air Investigation

- o Air sampling

Soil, Sediment and Surface Water Investigation

- o On-site surface water and seep sampling
- o On-site sediment sampling
- o On-site, off-site, surface and subsurface soil sampling

Groundwater Investigation

- o Monitoring well installation
- o Groundwater monitoring well and residential well sampling
- o Hydraulic conductivity testing

Numerous difficulties were encountered during Phase I drilling and well installation due to weathered and fractured bedrock conditions at the site. As a result, additional data needs were identified and proposed as a Phase II RI effort. The following identifies the Phase II RI activities performed to, fill data needs and further characterize the Dorney Road Landfill Site:

- o Installed one deep well off-site (MW-6) to the southeast.

- o Installed an off-site well nest (MW-7/7D) to the northwest on the Wessner property.

- o Installed one on-site boring (TB-LMW-4) in the vicinity of LMW-4.
- o Installed four borings (TB-1, 2, 3, 4) along the southeast corner of the site just west of MW-2/2D.

- o Obtained six additional groundwater samples (MW-6, 7, 7D, two rounds) and analyze for full HSL parameter plus unfiltered metal analysis.

- o Performed borehole geophysics in off-site wells (MW-2D, 3D, 4, 5D, 6, 7, 7D).

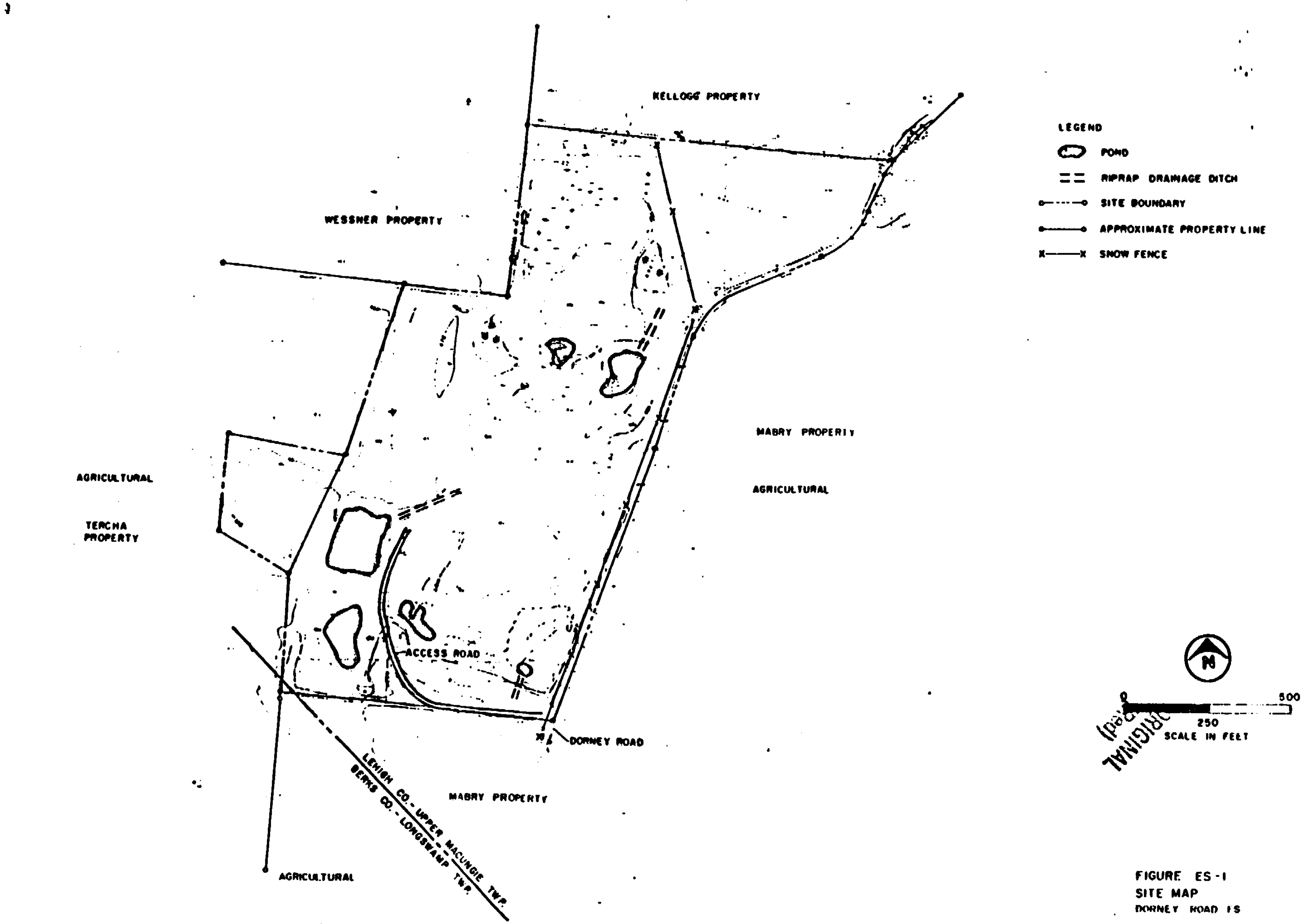

FIGURE ES-1
SITE MAP
DORNEY ROAD FS

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MAJOR FINDINGS OF THE REMEDIAL INVESTIGATION

The following paragraphs present the major findings and conclusions for each media sampled based on the results from the data obtained. A site map is presented on Figure E-1 to serve as a locational reference for the site features mentioned.

Based on available literature, two water supply aquifers are present in the Great Valley portion (Lehigh Valley) of Lehigh County and within the vicinity of the Dorney Road Landfill Site. The primary productive zone is a deeper aquifer associated with the highly weathered, highly fractured Lower Ordovician and Upper Cambrian carbonate units. The second aquifer is the less extensive overburden aquifer associated with the intergranular porosity within the thick residual soils and located where residual soils extend deep enough to intercept the piezometric surface of the water-table aquifer.

Two aquifers can be identified within the remedial investigation area. These are the shallow perched aquifer associated with the waste disposal area within the landfill and the water-table aquifer which underlies the entire study area. Deep residual soils intersect the water-table aquifer in several locations; however, this aquifer was evaluated as a single unit within this report.

Although minor shallow saturated soil zones were detected during the installation of two of the off-site wells, these zones are believed to be limited in areal extent. Lateral migration through the vadose zone due to the mounding within the perched system of the landfill may have resulted in low level contamination of localized areas in close proximity to the landfill which are not related to the water-table aquifer. This would explain the presence of organic compounds present in both upgradient wells and within well nest MW-7/7D and would explain the slight soil contamination at the upgradient location MW-1/1D (as outlined in Section 4.4 of the RI).

The perched system within the landfill exhibits two prominent features on the piezometric surface of the aquifer. These are designated as a groundwater mound and a groundwater depression. The groundwater mound appears to cause dilution of on-site leachate as exhibited in the groundwater analysis for LMW-3. The groundwater depression exhibited within the perched system closely coincides with the pit area of the abandoned iron mining operation. This is probably due to the presence of coarse pit cleaning material which was disposed within this portion of the site before and/or during the landfilling operation. The central portion of this depression is located within the vicinity or LMW-4. This area coincides with the location of the maximum organic concentrations detected in the on-site, downgradient, and off-site groundwater. This depression area is believed to be the primary discharge point for the landfill leachate. A possible secondary discharge point is identified within the landfill perched system upgradient of wells MW-3/3D and MW-4. The observed effect on the water-table aquifer, however, may be related to the normal infiltration of increased contaminant concentrations within this area of the site rather than a second area of increased discharge from the perched system.

Contaminant migration from the waste area is primarily via vertical downward migration until the water-table is intercepted where upon the controlling factors for flow within the water-table dictate the horizontal and vertical distribution of contaminants migrating from the site area. These controlling factors are horizontal and vertical gradients, primary fracture orientation and to a lesser extent the possibility for flow along bedding plane interfaces. This later controlling factor however is believed to be minimal.

Contaminants emanating from the southern half are transported south/southeast as indicated by the horizontal gradient beneath the site. This gradient is not apparently controlled by fracture orientation but appears to be responding to topographic controls. After contaminants exit along the southern portion of the site the presence of a major fracture system within this area apparently diverts flow towards the east/southeast. Contaminants in the northern half of the site are transported in a northern, eastern and southern direction in response to horizontal gradients observed in this area. It is presumed that the contaminant plume is then diverted toward the east/southeast in response to primary fracture orientation as indicated in the southern portion of the site.

The effects of the vertical downward and upward gradients on contaminants migrating from the site are opposite in nature in that downward (recharge area) gradients tend to carry contaminants into the deeper portion of the aquifer and upward (discharge area) gradients tend to prevent migration into the deeper portion of the aquifer. Since the majority of the site is underlain by a vertical upward gradient (discharge area), contaminants migrating from this portion of the site would tend to be transported along a shallow layer on top of the water-table (i.e., stratification of the water-table aquifer). This stratification would dissipate with distance from the site. Although this was indicated within the borehole geophysical survey, the analytical results of the off-site monitoring wells are inadequate to further substantiate the presence of any zonation within the water-table aquifer.

Based on both surface and subsurface soil analytical results, two generalized areas of elevated organic and inorganic contamination can be identified. These are the areas located within the north-central portion of the site and the area located at the southern property line and extending into the field area located immediately south of the site.

A comparison between the waste soils and the underlying natural soils at LMW-7 and LMW-3 was made to estimate the potential for contamination to move from the waste soil and penetrate the natural soil underneath the landfill. The comparison was limited to VOCs since they are typically more mobile due to their solubilities. Four of the six VOCs detected in the waste at LMW-7 were also found in the natural soils. Seven of the eight VOCs detected in waste at LMW-3 were also found in the natural soils. Based on these close chemical similarities and concentrations between the waste soil and the underlying natural soil, it can be concluded that a downward migration of site contaminants from the waste does exist.

Levels of contaminants that exceeded background were detected in the on-site surface, subsurface waste, subsurface natural, and perimeter surface soils. These site related contaminants were found to be off-site as well as on-site. These on-site and off-site correlations identified indicate that site contamination is leaving the Dorney Road Landfill.

Due to the lack of any streams within the vicinity of the site, surface water and sediment samples were only collected from the ponded areas located on top of the landfill. Six samples were collected, including a duplicate sample. Interpretation of the data indicates a relationship between surface water/sediment contamination and soil contamination. Areas of highest surface water and sediment concentrations coincide with areas of highest surface soil contamination. Surface water and sediment sample SW/SD-005, located within the catch basin for the contaminated surface soil area identified contaminants believed to be associated with surface runoff.

Based on a site reconnaissance performed in September 16, 1987, no readings above background were detected to indicate the presence of organic vapors, combustible gases or radionuclides. Analytical results for the quantitative air sampling effort indicate that insignificant levels of airborne contaminants were detected at all locations during the sampling period. Evaluation of maximum concentrations for select groups of prevalent contaminants detected at the site and their corresponding TLVs reveal that maximum concentrations detected on-site (in the parts per billion, ppb) are well below acceptable industrial exposure.

The potential risks to human health attributed to chemicals present at the Dorney Road Landfill Site were evaluated under a number of exposure scenarios. Potential pathways of exposure to chemicals originating at the site under both current-use and hypothetical future-use conditions were examined. Table E-1 presents a summary of the risks associated with the various scenarios evaluated.

Under current-use exposure scenarios, several pathways identified both carcinogenic and non-carcinogenic risks exceeding those normally considered acceptable at hazardous waste sites. These exposure scenarios include dermal exposures and incidental ingestion by on-site trespassers of contaminated soils and surface water and the ingestion of contaminated groundwater by nearby residents. The surface water hazard was associated only with a small surface water feature located in the northwest portion of the site. Future-use scenarios that identified hazards associated with the site include dermal contact and incidental ingestion of soils by future site residents and the consumption of groundwater by both on-site and near site residents.

TABLE E-1
SUMMARY OF POTENTIAL RISKS ASSOCIATED WITH THE DORNEY ROAD SITE
DORNEY ROAD FS

Exposure Scenario	Total Cancer Risks		Noncarcinogenic Hazard Index	
	Average	Plausible Maximum	Average	Plausible Maximum
Current Condition - Soil				
On-site Teenagers	2.39×10^{-8}	3.96×10^{-6}	<1	>1
On-site Adults	2.11×10^{-7}	3.19×10^{-5}	<1	>1
Current Conditions - Surface Water				
On-site Teenagers	NE	9.28×10^{-7}	<1	<1
On-site Adults	NE	1.68×10^{-5}	<1	<1
Current Conditions - Sediments				
On-site Teenagers	NA	1.19×10^{-10}	NA	<1
On-site Adults	NA	9.75×10^{-10}	NA	<1
Current Conditions - Leachate Seeps				
On-site Teenagers	NA	NA	NA	<1
On-site Adults	NA	NA	NA	<1
Current Conditions - Ground Water				
Residential Wells	7.14×10^{-6}	3.18×10^{-5}	<1	<1
Future Use - Soils				
Residents	8.51×10^{-7}	9.17×10^{-5}	<1	>1
Future Use - Ground Water				
On-site Wells	1.46×10^{-3}	9.61×10^{-3}	>1	>1
Future Use Ground Water				
Shallow Off-site	9.02×10^{-4}	4.23×10^{-3}	>1	>1
Future Use - Groundwater				
Deep Wells	1.47×10^{-4}	3.01×10^{-4}	<1	1
Future Use - Surface Soils				
On-site Workers	2.13×10^{-7}	1.97×10^{-5}	<1	>1
Future Use - Subsurface Soils				
On-site Workers	4.21×10^{-8}	8.83×10^{-3}	<1	<1

NA - Not Applicable
NE - Not Evaluated

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IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES

General response actions are first identified to define several general strategies for site remediation. Remedial technologies corresponding to each of the general response actions are then identified and evaluated for their effectiveness and implementability at the site. Technologies retained through the screening process are subsequently assembled into a range of remedial alternatives addressing each of the Remedial Response Objectives.

General response actions are broad classes of responses or remedies intended to meet the remedial action objectives set for the site. Each general response action defines a specific approach to remediation of the onsite contamination. While response actions are presented as separate, stand-alone remediation strategies, two or more may be used in combination to provide a more comprehensive approach to site clean-up. The following response actions have been identified to meet the Remedial Response Objectives:

- <u>Minimal/No Action</u>: Implementation of institutional actions and other indirect methods of reducing exposure to site hazards.
- <u>Containment</u>: Physical isolation of contaminated media to minimize potential exposure and reduce migration of contaminants to groundwater.
- <u>Removal</u>: Physical removal of contaminated media.
- <u>Disposal</u>: Placement of contaminated media or treatment residue into secure, permanent storage. Removal action will also be required in conjunction with disposal.
- <u>Treatment</u>: Alteration of contaminated media to destroy, remove, or immobilize contaminants. Removal action and/or disposal action may be required in conjunction with treatment.

Potentially applicable remedial technologies identified to address each of the five response action categories will be screened using three basic criteria. These remedial technologies will address only hazards associated with contaminated solid wastes, soils and surface water. The only surface water to be addressed is one small pond located in the northwest portion of the site.

The remedial technologies are screened in this section to identify a set of technologies for use in assembling remedial alternatives. The screening process is based on the following criteria:

- <u>Effectiveness</u>: The ability of each technology to effectively attain the given response action is assessed based on the site-specific conditions. Technologies which will not effectively achieve the desired goal due to the nature of the site and site contaminants will be eliminated.

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o Implementability: Technologies will also be evaluated to determine whether they can be adequately implemented based on acceptable engineering practices and administrative considerations.

Relative cost will also be used, to a limited extent, to evaluate technologies which offer similar effectiveness and implementability in addressing the same response action. A technology may be eliminated if there exists another technology addressing the same response action that is equally feasible and beneficial but less costly. It can not be used to differentiate between treatment and non-treatment technologies.

The screening process is intended to identify those technologies that are most appropriate to attain the remedial action objectives, given the site conditions. This screening process considers major effects and does not necessarily rely on quantification to identify and eliminate less feasible technologies. Thirty-two potentially applicable technologies have been screened to determine their feasibility for use at the Dorney Road Landfill Site. Fifteen of these technologies have been retained for incorporation into the comprehensive remedial alternatives.

ASSEMBLY OF REMEDIAL ALTERNATIVES

Based on the remedial response objectives, five remedial alternatives are developed which provide varying degrees of human health and environmental protection. These alternatives incorporate the remedial technologies retained through the screening process. A discussion of each alternative is provided below.

Alternative No. 1: Minimal/No Action

The National Contingency Plan (NCP) requires that a "no action" alternative be evaluated through the detailed analysis to provide a baseline for comparison to other alternatives. This alternative provides minimal to no protection of human health and no protection of the environment. The resultant risks associated with the Minimal/No Action alternative would be the same as those identified in the Public Health Evaluation included in the RI and the risk assessment summarized in Section 2 of this report.

Several minimal actions would be required, even with the "no action" alternative. These are:

- o Perimeter Fence
- o Deed Restrictions
- o Runoff Monitoring
- o Groundwater Monitoring

Alternative No. 2: Soil Cover

Alternative No. 2 is intended to provide protection of human health by eliminating the exposure pathway for solid media contaminants, but provide minimal protection of the environment. The soil cover would act as a physical barrier over the contaminated solid media, thus reducing potential contact and incidental ingestion of contaminants. Migration of contaminants from the solid media to groundwater would not be significantly reduced, as infiltration would remain relatively unaffected. Alternative No. 2 includes the following major components:

- o Perimeter Fence
- o Deed Restrictions
- o Surface Water Elimination
- o Regrading
- o Runon/Runoff Controls
- o Soil Cover
- o Runoff Monitoring
- o Groundwater Monitoring

<u>Alternative No. 3A: RCRA-Type Multi-Layer Cap</u>

Implementation of Alternative No. 3A is intended to provide protection of both human health and the environment. The multi-layer cap would act as an effective barrier virtually eliminating hazards of direct contact and incidental ingestion of contaminants. In addition, the impermeable cap would minimize infiltration, thus reducing migration of contaminants from the solid media to groundwater. The major components of this alternative are as follows:

- o Perimeter Fence
- o Deed Restrictions
- o Surface Water Elimination
- o Regrading
- o Runon/Runoff Controls
- o RCRA-Type Multi-Layer Cap
- o Runoff Monitoring
- o Groundwater Monitoring

<u>Alternative No. 3B: PA-Type Multi-Layer Cap</u>

Alternative 3-B has the same major component and is identical to Alternative 3A except that construction of the multi-layer cap would conform to PA Solid Waste Regulations (PA Statutes, Title 25, 75.264(v)) rather than RCRA guidance. The degree of protectiveness is equal with either cap configuration; however, the cap compliant with PA regulations would be significantly less costly. The area covered would be the same as that defined for Alternative 3A.

The PADER-compliant cap would consist of a one foot thick compacted earth base course, a 50 mil flexible synthetic liner, a synthetic drainage layer, and a two foot thick vegetated loam layer. A gas collection system consisting of a 6 inch thick gravel layer and well type vents would also be included beneath the compacted earth base course. Construction considerations would be the same as described for the RCRA-type cap.

Alternative No. 4: Onsite RCRA Landfill

This alternative would provide complete, three-dimensional containment of waste material, thus minimizing risks to both human health and the environment. The contaminated solid media would, however, remain onsite indefinitely, posing potential future risks. The following elements are incorporated in this alternative:

- Perimeter Fence
- Deed Restrictions
- Surface Water Elimination
- Excavation
- RCRA-Type Landfill
- RCRA-Type Multi-Layer Cap
- Runon/Runoff Controls
- Runoff Monitoring
- Groundwater Monitoring

Alternative No. 5: Onsite Incineration

Implementation of this alternative would provide complete destruction of organic contaminants and subsequent containment of ash residue containing inorganic contaminants. The result would be maximum protection of both human health and the environment from risks posed by the contaminated solid media. The following components are included in this alternative:

- Perimeter Fence
- Deed Restrictions
- Surface Water Elimination
- Excavation
- Incineration
- RCRA-Type Landfill
- RCRA-Type Multi-Layer Cap
- Runon/Runoff Controls
- Runoff Monitoring
- Groundwater Monitoring

SUMMARY OF DETAILED ANALYSIS OF ALTERNATIVES

The detailed evaluation of each alternative is summarized and compared to the other alternatives through a discussion of the following eight evaluation criteria: short-term effectiveness, long-term effectiveness, reduction of Toxicity, Mobility, and Volume (TMV), implementability, cost, compliance with ARARs, overall protection of Human Health and the Environment, and community acceptance.

ORIGINAL (Red)

Short-Term Effectiveness

Potential risks to the local population should not increase during implementation of any of the remedial alternatives since there are no residents living within 1,000 ft. of the site. Excavation of the contaminated waste during construction of Alternatives 4 and 5 would, however, pose low exposure risks due to inhalation of organic vapors or fugitive dust for travelers on Dorney Road. Migratory waterfowl and other wildlife currently residing near the site would be temporarily displaced during construction of all alternatives, except Alternative 1.

Workers responsible for implementing the remedial actions may be exposed to risks associated with dermal contract, incidental ingestion, and inhalation of organic vapors or fugitive dust during construction. These risks would be extremely low for implementation of Alternative 1 since work would be performed at the site perimeter and the construction period would be brief (less than one month). Implementation of Alternatives 2 and 3A/3B could pose low to moderate risks to workers since the contaminated surface soils and waste would be disturbed during regrading. The duration of the construction period for Alternatives 2 and 3A/3B would, however, be less than one year. Implementation of Alternatives 4 and 5 would present moderate risks to workers due to the extensive excavation and handling of contaminated waste required and the relatively long construction period (approximately 5 years for Alternative 4 and 12 years for Alternative 5).

Long-Term Effectiveness

Alternative 1 would provide minimal reduction of the identified, existing risks by limiting access of hunters and other site trespassers and deterring future use of the site. Monitoring of surface and groundwater would indicate the need for subsequent action. The reliability of the site fence is relatively high, but is dependent upon continued inspection and maintenance, while enforcement of deed restrictions would be difficult to ensure. Monitoring technologies are well developed and reliable, but only indicate the presence of a problem rather than performing a protective function.

Alternatives 2, 3A and 3B should be equally effective in reducing the risks of dermal contact and incidental ingestion of contaminated soil, solid waste, and surface water. Alternative 2 would not be protective of groundwater, while Alternatives 3A and 3B would reduce infiltration and the associated leaching of solid waste contaminants to the water table. The reliability of the soil cover in Alternative 2 is considerably less than that afforded by the multi-layer caps of Alternatives 3A and 3B. Of the RCRA and PA-type caps, the RCRA cap offers slightly greater reliability since a clay liner layer is employed, in addition to the synthetic liner. The potential for future risk would still exist with implementation of Alternatives 2, 3A or 3B since contaminants would be left on site.

Alternatives 4 and 5 would provide maximum protectiveness as they eliminate both exposure risks and leaching of contaminants to groundwater. Properly constructed, a lined landfill should be very reliable; however, the reliability is dependent upon continued maintenance and monitoring. In Alternative 4, contaminants remain on site indefinitely; therefore, there would be a potential for future risks should the landfill liner fail. All organic contaminants would be destroyed in Alternative 5, thus minimizing the potential for future risks from organics in the event of liner failure.

Reduction of Toxicity, Mobility, and Volume (TMV)

The TMV of site contaminants would be unaffected by implementation of Alternative 1. Alternatives 2, 3A and 3B would provide little to moderate reduction of contaminant mobility. These alternatives would reduce the mobility of surface contaminants, while Alternatives 3A and 3B would also reduce the mobility subsurface contaminants leaching to groundwater. Contaminants would be completely immobilized in Alternative 4, but toxicity and volume would be unaffected. Implementation of Alternative 5 would result in the most complete reduction of TMV as incineration would destroy all organic contaminants, while residual inorganic contaminants would be immobilized within a lined landfill.

Implementability

Implementation of Alternative 1 would be extremely simple, requiring only the construction of a fence around the site and periodic monitoring of existing wells and surface water. Implementation of Alternative 2 should also prove relatively easy as the civil construction techniques required are well developed and commonly used. Alternatives 3A and 3B would be somewhat more difficult to implement due to the complex construction of the multi-layer cap. Multi-layer cap construction, however, is well developed and should not pose a major problem with adequate engineering design. Implementation of Alternatives 4 and 5 would be extremely difficult due to the volume of contaminated waste to be handled and the necessity for staged construction with simultaneous excavation and liner construction. Operation and coordination of the incinerator with excavation and backfilling of the waste would increase the complexity of the engineering design and site work for Alternative 5. Implementation of Alternatives 4 and 5 would not be impossible, but would require complex design and construction techniques.

Cost

The total capital and total present worth costs for all alternatives are summarized and presented in Table E-2.

Compliance with ARARs

All alternatives would be designed to meet action specific ARARs, with the exception of Alternative 3B which would not comply with RCRA design requirements for cap construction. No location-specific ARARs were found to

TABLE E-2
SUMMARY OF TOTAL COSTS FOR ALL ALTERNATIVES
DORNEY ROAD FS

Alternative No.	Description	Total Capital Cost	Total Present Worth Cost*
1	Minimal/No Action	$ 120,000	$ 760,000
2	Soil Cover	$ 5,300,000	$ 6,900,000
3A	RCRA Multi-Layer Cap	$13,000,000	$ 15,000,000
3B	PA-Type Multi-Layer Cap	$12,000,000	$ 14,000,000
4	Onsite RCRA Landfill	$19,000,000	$ 46,000,000
5	Onsite Incineration	$28,000,000	$670,000,000

*Present worth calculated over 30 year period at 5% interest rate.

be applicable for any of the remedial actions considered. Chemical-specific ARARs were considered as they apply to surface water quality and air quality. For Alternatives 2, 3A, 3B, 4 and 5, surface water discharged to local drainage, as well as the treated contaminated surface water, would meet Pennsylvania Water Quality Standards and Federal Ambient Water Quality Criteria. Contaminated surface water remaining on site in Alternative 1 would not meet water quality standards. Controls would be implemented during excavation in Alternatives 2, 3A, 3B, 4 and 5 to reduce particulate and contaminant vapor concentrations in air to acceptable levels under State and Federal air quality regulations. Incinerator emissions would also meet State and Federal air quality requirements.

Overall Protection of Human Health and the Environment

The alternatives evaluated offer a wide range of overall protectiveness from almost no protection of human health or the environment to maximization of protection. Alternative 1 would provide minimal protection of human health by restricting access to the site and no protection of the environment. The current site-related risks identified in the PHE would be unmitigated. Alternative 2 would greatly reduce the risks of incidental ingestion and dermal absorption of contaminated surface water and solid waste by placing a clean soil cover over the site. The leaching of solid waste contaminants to groundwater would not be significantly reduced by implementation of this alternative. Alternatives 3A and 3B would offer the same protection of human health as Alternative 2, but with the increased reliability of a multi-layer cap. In addition, Alternatives 3A and 3B would prevent infiltration of precipitation into the waste, thus reducing the leaching of contaminants to groundwater. Implementation of Alternatives 1, 2, 3A and 3B would pose minimal short-term risks during construction. Alternative 4 would provide complete three-dimensional containment of the waste material, thus eliminating human health and environmental risks. Contaminated solid media would, however, remain on site indefinitely, with the potential for future release. Alternative 4 would require approximately five years to implement, during which time workers would be exposed to moderate health risks. Alternative 5 would afford maximum protection of both the environment and public health since all organic contaminants would be destroyed and the residual inorganic contaminants would be completely contained within a lined landfill on site. However, implementation of this alternative would require about 12 years to complete, during which time site risks would not be fully mitigated and workers would be exposed to moderate health risks.

Community Acceptance

To be addressed after public comment period.

1.0 INTRODUCTION

The purpose of this Feasibility Study (FS) report is to summarize the process used to develop and evaluate remedial action alternatives to mitigate public health and environmental hazards associated with the dermal contact and incidental ingestion of the landfill proper (soil, solid waste and surface water) at the Dorney Road Landfill site. Groundwater will be addressed in a supplemental FS. The FS was performed so that the Pennsylvania Department of Environmental Resources (PADER) and the U. S. Environmental Protection Agency (EPA) can select an alternative or alternatives consistent with the goals of CERCLA as amended by the 1986 Superfund Amendments and Reauthorization Act (SARA), and the National Contingency Plan (NCP). In accordance with the NCP, the appropriate extent of remedy is defined as a "cost-effective remedial alternative that effectively mitigates and minimizes threats to and provides adequate protection of public health and welfare and the environment" [40 CFR 300.68(i)]. This FS is based on the information and data presented in the Remedial Investigation (RI) Report.

The methodology used in this FS report allows a step-by-step evaluation of technologies, alternatives and assembled alternatives by progressing through a series of screenings and evaluations. Initially, general qualitative information is used. Subsequently, more refined and quantitative information is used to eliminate from consideration infeasible or otherwise unacceptable actions. This methodology provides a systematic procedure for identifying and evaluating alternatives, specifying criteria for determining the magnitude and importance of effects resulting from the implementation of an action, and considering measures to mitigate adverse effects.

1.1 SITE LOCATION AND DESCRIPTION

The Dorney Road Landfill Site (Oswald's Landfill) is located along the southwest boundary of Upper Macungie Township in Lehigh County, Pennsylvania, approximately eight miles southwest of Allentown. The site is located on the United States Geological Survey (USGS) 7.5 minute topographic map, Topton, Pennsylvania Quadrangle. The site lies one mile southwest of Breinigsville and 1.4 miles north-northwest of Mertztown. The site location is shown on Figure 1-1. The site is composed of approximately 27 acres of documented landfill which is bounded to the east by Dorney Road and extends westward such that the southwest corner of the site is in Longswamp Township, Berks County.

Most of the Dorney Road Site consists of an abandoned landfill surrounded by a perimeter soil berm. Prior to 1966, the site was an open dump with waste disposed in an abandoned iron mine pit. Native vegetation was probably destroyed by prior site activities. From 1966 to 1978, a landfill was operated in the same abandoned mine pit. Due to the nature of wastes and/or the generally thin soil cover at the Dorney Road Landfill, vegetation is sparse within several areas of the landfill. Sparse vegetation growth can also be attributed to a 1986 USEPA regrading effort. Several ponds remain on site following the 1986 USEPA surface regrading effort. Discharge from the southernmost onsite ponds is directed to the southeast corner of the site and then offsite to the south via a riprap channel. Discharge from the

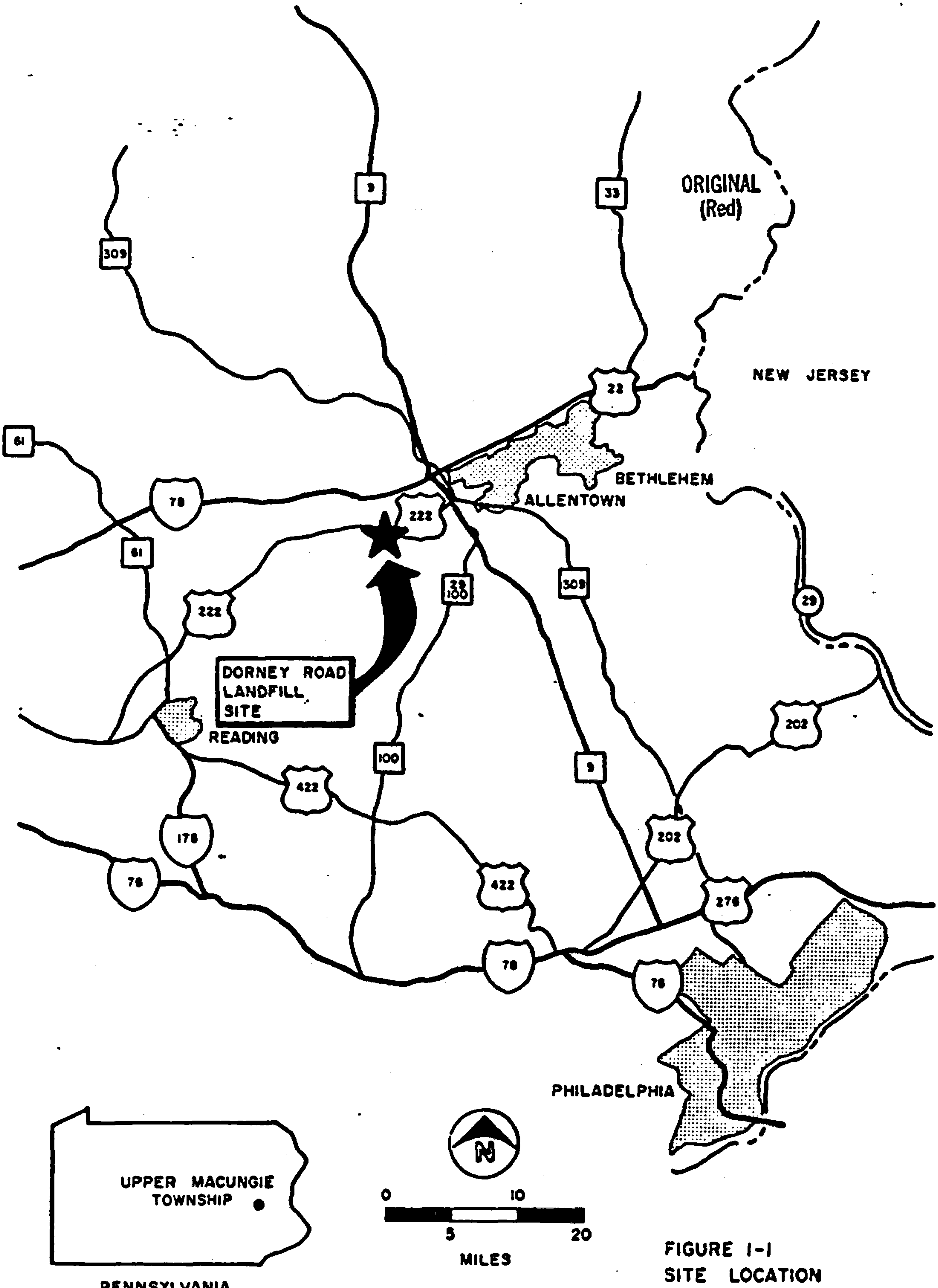


FIGURE 1-1
SITE LOCATION
DORNEY ROAD FS

northeast onsite pond is to the north and offsite to the north via a riprap channel. Ground surface elevations range from approximately 430 feet above mean sea level (MSL) to 470 ft. MSL. The general layout of the site and surrounding area is shown on Figure 1-2.

The land use of the area surrounding the site is essentially rural residential and agricultural. The local area is zoned for agricultural use and the site is completely surrounded by cultivated farmland where the principal crops are soybeans and corn for dairy and beef cattle feed. Of the 15,847 acres available in Upper Macungie Township, 10,952 acres (or 69%) is considered agricultural and vacant acres. The remaining 4,895 acres (or 31%) is used for other purposes.

The population of Lehigh County in 1980 was about 272,000, with a population projection of about 288,000 by 1990. The population of Upper Macungie Township in Lehigh County in 1980 was about 7,500, with a population projection of about 8,800 by 1990. Population within a quarter mile radius of the site is estimated to be about 20. At present, only one residence is located within 1,000 ft. of the site and three other residences are located within 2,000 ft. of the site. The water supply for residents of these nearby homes is groundwater from private wells.

The Dorney Road Site lies within the Great Valley Physiographic Province area located in Lehigh and Berks Counties, Pennsylvania. This region is primarily underlain by carbonate rocks and consists of gently rolling hills.

Most of Lehigh County (approximately 61%) is considered undeveloped or agricultural land based on 1986 land use figures provided by the Joint Planning Commission of Lehigh-Northampton Counties. The remaining acreage has been developed for sporadic residential, commercial, industrial, wholesale and warehousing, transportation, communication and utilities, public and quasi-public parks and recreation uses.

Wildlife on and adjacent to the site is quite varied because of its rural setting of open land and woodland environments. Ringneck pheasant, white-tail deer, cottontail rabbits, ducks, Canada geese, smaller bird varieties and small rodents were also observed on site during the RI field activities.

Precipitation data available for the site is as follows:

Maximum Precipitation	67.7 in./yr.
Average Precipitation	42.9 in./yr.
Maximum Monthly Precipitation (August, 1955)	12.10 in.
Minimum Monthly Precipitation (May, 1964)	0.09 in.
Station of Record: Allentown-Bethlehem-Easton Airport	
Length of Historical Record:	50 years

Approximately 60% of the average annual precipitation of 42.9 in. per year is lost to evapotranspiration and 40% is available for surface water runoff and groundwater recharge. The prevailing winds are from the west-northwest.

1.2 SITE HISTORY, WASTE DISPOSAL, AND PRIOR REMEDIAL ACTION ACTIVITIES

The majority of the site is currently owned by Emory Mabry of Mertztown, Pennsylvania. A portion of the westernmost protrusion formerly owned by the Mertz estate is currently owned by Robert Tercha. Other surrounding landowners included the Kelloggs and Wessners. Prior to 1966, the site was operated as an open dump with waste being disposed in an abandoned iron mine pit. In 1966, Harold E. Oswald began operating a landfill at the site. In a letter dated January 8, 1970, the Pennsylvania State Health Center notified Mr. Oswald that the operation of the site as a landfill constituted a public health threat and required him to compact the fill and apply cover to the site. A followup letter on March 9, 1970, indicated that Mr. Oswald had not complied with this directive.

In June, 1970, a representative from the Pennsylvania Department of Environmental Resources (PADER) visited the site, noting the approximate location of an onsite area used for the disposal of sludge from a General Electric plant in Allentown, Pennsylvania. According to the PADER, approximately 6 cu. yds. of the sludge was disposed each day. The period over which the disposal occurred is not known. Mr. Oswald applied for a landfill permit in a submittal dated August 27, 1970. Although the application was never approved, landfill operations continued until December 30, 1978.

A letter dated November 15, 1972 from the State Health Center to Mr. Oswald noted the existence of battery casings on site. Notes taken by a State soil scientist during a site visit on October 26, 1973 indicated that "several barrels of petroleum products" were disposed in a trench on site. A State memorandum dated September 14, 1976 listed the following four wastes that had been disposed of at the landfill:

- Approximately one-half of a pickup truck of sludge from the General Electric Plant.
- Approximately 25 cu. yds. of sludge from Richard-Carlston, Inc. of Bethlehem, Pennsylvania.
- Batteries from Deka Battery of "East Penn."
- Approximately 400 lbs. per year of asbestos waste from Atlas Mineral (city unknown).

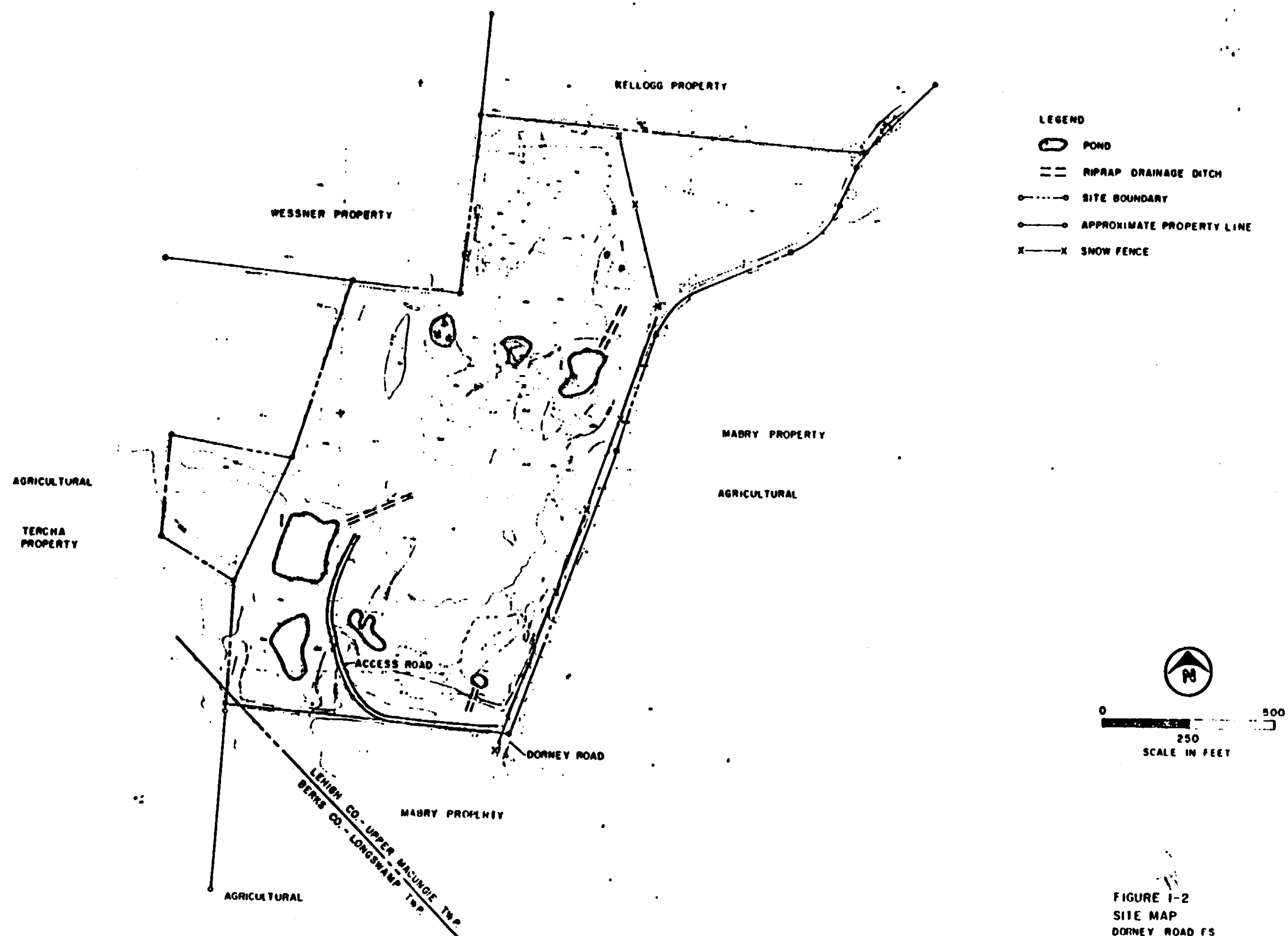


FIGURE 1-2
SITE MAP
DORNEY ROAD FS

On September 28, 1979, Mr. Edward Reeser of Whitehall, Pennsylvania, applied for a landfill permit to renew disposal operations at the site, but the permit was not granted.

On May 21, 1980, approximately two years after the landfill ceased operations, the Hazardous Materials Branch of the EPA sampled groundwater and leachate at the site. Organic contaminants detected in the samples included petroleum hydrocarbons and halogenated hydrocarbons. Inorganic contaminants detected included arsenic, cadmium, chromium and lead.

On June 5, 1982, the Annapolis Field Office of the USEPA inspected the site and collected groundwater samples. The results of their analyses are not available.

On December 8, 1982, PADER representatives collected water and groundwater samples at the site. High levels of lead were detected in the surface water and phenols were detected in the groundwater. On January 5, 1983, PADER sampled water from three residential wells in the area, but no adverse impacts to the groundwater at these locations were identified. On January 13, 1983, PADER sampled surficial soils from the landfill area and on site. Elevated levels of lead were detected in the soil samples from the landfill.

On April 21, 1983, USEPA Field Investigation Team (FIT) visited the site and monitored air quality with an HNu photoionization detector (PID). No readings above background were detected.

On April 19, 1984, the USEPA Technical Assistance Team (TAT) collected soil, sediment and surface water samples from the site. Elevated levels of metals, phenols, and toluene were detected in the samples.

1.3 OVERVIEW OF REMEDIAL INVESTIGATION

The field activities performed during the Dorney Road RI were conducted in two phases. Phase II as authorized by PADER consisted of an additional scope of work for the collection of additional data and was performed immediately following the Phase I RI.

1.3.1 Phase I Remedial Investigation

During the Phase I RI, activities performed were:

- Air sampling
- Fracture trace analysis
- Geophysical investigation (seismic refraction)
- Onsite surface water and seep sampling
- Onsite sediment sampling
- Onsite and offsite soil sampling
- Monitoring well installation
- Groundwater and residential well sampling
- Hydraulic conductivity testing

Air sampling was performed to determine the quantity and quality of ambient airborne contaminants for evaluation of the potential exposure to onsite workers and neighboring populations. The data was used to determine the appropriate level of protection on site, and to establish the exclusion, contamination reduction, and support zone delineations used during the field activities.

The fracture trace analysis was performed by an ICF/SRW hydrogeologist to provide information on the number, size, frequency and orientation of lineaments. The data were used to assist in locating monitoring wells and for information regarding the potential for contaminant migration through bedrock.

The geophysical investigation (seismic refraction survey) was performed to obtain information on the thickness of overburden and the depth to bedrock, the thickness of the landfill, the condition of the bedrock at the iron mine pit, and the condition of bedrock at lineaments identified in the fracture trace analysis.

The sampling and analysis of the onsite ponds were performed to collect data on the contaminant concentrations in the standing liquid and bottom sediments in the ponds. The data are to be used to estimate the extent and degree of contamination and estimate the volumes of liquid and soil to be treated and/or removed.

Onsite and offsite soil sampling was performed to provide data on the background chemical characteristics of soils isolated from possible site-related contamination, the degree of offsite migration of contamination, and the onsite vertical and horizontal extent of contamination. The sampling and analysis of onsite soils will be used to estimate the extent and degree of contamination and to estimate volumes of soil to be treated and/or removed.

The objective of the monitoring well installation and groundwater sampling activities was to obtain site specific geologic, hydrogeologic and potential groundwater contamination information. Hydraulic conductivity testing was performed to provide data on the characteristics of the water bearing units existing at the site.

1.3.2 Phase II Remedial Investigation

The additional work performed following the Phase I investigation to further characterize the Dorney Road Landfill Site was as follows:

- Monitoring well installation
- Test boring drilling
- Groundwater sampling
- Borehole geophysical logging

Monitoring wells were installed to provide additional information on groundwater contamination adjacent to the site. One well was installed to determine water quality along a fracture identified during fracture trace analysis and a well nest was installed to provide background/upgradient water quality data.

One test boring was drilled to estimate the thickness of soil underlying waste materials while four borings were drilled to attempt to intercept and confirm the presence of a shallow, perched groundwater zone.

Groundwater samples were obtained during two rounds of sampling of the three wells installed during Phase II.

Finally, geophysical logging of 7 wells was performed to provide stratification data encountered in these wells. The drilling methods that were necessary to install the wells did not provide core samples of the bedrock that could be used to identify the types of rock in which the wells were placed.

1.3.3 Summary of Remedial Investigation

The following paragraphs present the major findings and conclusions for each media sampled based on the results from the Phase I and Phase II RI data obtained.

Based on available literature, two water supply aquifers are present in the Great Valley portion (Lehigh Valley) of Lehigh County and within the vicinity of the Dorney Road Landfill Site. The primary productive zone is a deeper aquifer associated with the highly weathered, highly fractured Lower Ordovician and Upper Cambrian carbonate units. The second aquifer is the less extensive overburden aquifer associated with the intergranular porosity within the thick residual soils and located where residual soils extend deep enough to intercept the piezometric surface of the water-table aquifer.

Two aquifers can be identified within the remedial investigation area. These are the shallow perched aquifer associated with the waste disposal area within the landfill and the water-table aquifer which underlies the entire study area. Deep residual soils intersect the water-table aquifer in several locations; however, this aquifer was evaluated as a single unit within this report.

Although minor shallow saturated soil zones were detected during the installation of two of the off-site wells, these zones are believed to be limited in areal extent. Lateral migration through the vadose zone due to the mounding within the perched system of the landfill may have resulted in low level contamination of localized areas in close proximity to the landfill which are not related to the water-table aquifer. This would explain the presence of organic compounds present in both upgradient wells and within well nest MW-7/7D and would explain the slight soil contamination at the upgradient location MW-1/1D (as will be outlined in Section 4.4).

The perched system within the landfill exhibits two prominent features on the piezometric surface of the aquifer. These are designated as a groundwater mound and a groundwater depression. The groundwater mound appears to cause dilution of on-site leachate as exhibited in the groundwater analysis for LMW-3. The groundwater depression exhibited within the perched system closely coincides with the pit area of the abandoned iron mining operation. This is probably due to the presence of coarse pit cleaning material which was disposed within this portion of the site before and/or during the landfilling operation. The central portion of this depression is located within the vicinity or LMW-4. This area coincides with the location of the maximum organic concentrations detected in the on-site, downgradient, and off-site groundwater. This depression area is believed to be the primary discharge point for the landfill leachate. A possible secondary discharge point is identified within the landfill perched system upgradient of wells MW-3/3D and MW-4. The observed effect on the water-table aquifer, however, may be related to the normal infiltration of increased contaminant concentrations within this area of the site rather than a second area of increased discharge from the perched system.

Contaminant migration from the waste area is primarily via vertical downward migration until the water-table is intercepted where upon the controlling factors for flow within the water-table dictate the horizontal and vertical distribution of contaminants migrating from the site area. These controlling factors are horizontal and vertical gradients, primary fracture orientation and to a lesser extent the possibility for flow along bedding plane interfaces. This later controlling factor however is believed to be minimal.

Contaminants emanating from the southern half are transported south/southeast as indicated by the horizontal gradient beneath the site. This gradient is not apparently controlled by fracture orientation but appears to be responding to topographic controls. After contaminants exit along the southern portion of the site the presence of a major fracture system within this area apparently diverts flow towards the east/southeast. Contaminants in the northern half of the site are transported in a northern, eastern and southern direction in response to horizontal gradients observed in this area. It is presumed that the contaminant plume is then diverted toward the east/southeast in response to primary fracture orientation as indicated in the southern portion of the site.

The effects of the vertical downward and upward gradients on contaminants migrating from the site are opposite in nature in that downward (recharge area) gradients tend to carry contaminants into the deeper portion of the aquifer and upward (discharge area) gradients tend to prevent migration into the deeper portion of the aquifer. Since the majority of the site is underlain by a vertical upward gradient (discharge area), contaminants migrating from this portion of the site would tend to be transported along a shallow layer on top of the water-table (i.e., stratification of the water-table aquifer). This stratification would dissipate with distance from the site. Although this was indicated within the borehole geophysical survey, the analytical results of the off-site monitoring wells are inadequate to further substantiate the presence of any zonation within the water-table aquifer.

Based on both surface and subsurface soil analytical results, two generalized areas of elevated organic and inorganic contamination can be identified. These are the areas located within the north-central portion of the site and the area located at the southern property line and extending into the field area located immediately south of the site.

A comparison between the waste soils and the underlying natural soils at LMW-7 and LMW-3 was made to estimate the potential for contamination to move from the waste soil and penetrate the natural soil underneath the landfill. The comparison was limited to VOCs since they are typically more mobile due to their solubilities. Four of the six VOCs detected in the waste at LMW-7 were also found in the natural soils. Seven of the eight VOCs detected in waste at LMW-3 were also found in the natural soils. Based on these close chemical similarities and concentrations between the waste soil and the underlying natural soil, it can be concluded that a downward migration of site contaminants from the waste does exist.

Levels of contaminants that exceeded background were detected in the on-site surface, subsurface waste, subsurface natural, and perimeter surface soils. These site related contaminants were found to be off-site as well as on-site. These on-site and off-site correlations identified indicate that site contamination is leaving the Dorney Road Landfill.

Due to the lack of any streams within the vicinity of the site, surface water and sediment samples were only collected from the ponded areas located on top of the landfill. Six samples were collected, including a duplicate sample. Interpretation of the data indicates a relationship between surface water/sediment contamination and soil contamination. Areas of highest surface water and sediment concentrations coincide with areas of highest surface soil contamination. Surface water and sediment sample SW/SD-005, located within the catch basin for the contaminated surface soil area identified contaminants believed to be associated with surface runoff.

Based on a site reconnaissance performed in September 16, 1987, no readings above background were detected to indicate the presence of organic vapors, combustible gases or radionuclides. Analytical results for the quantitative air sampling effort indicate that insignificant levels of airborne contaminants were detected at all locations during the sampling period. Evaluation of maximum concentrations for select groups of prevalent contaminants detected at the site and their corresponding TLVs reveal that maximum concentrations detected on-site (in the parts per billion, ppb) are well below acceptable industrial exposure.

1.4 OVERVIEW OF PUBLIC HEALTH EVALUATION

The potential risks to human health attributed to chemicals present at the Dorney Road Landfill Site were evaluated under a number of exposure scenarios. Potential pathways of exposure to chemicals originating at the site under both current-use and hypothetical future-use conditions were examined. Table 1-1 presents a summary of the risks associated with the various scenarios evaluated.

Under current-use exposure scenarios, several pathways identified both carcinogenic and non-carcinogenic risks exceeding those normally considered acceptable at hazardous waste sites. These exposure scenarios include dermal exposures and incidental ingestion by onsite trespassers of contaminated soils and surface water and the ingestion of contaminated groundwater by nearby residents. The surface water hazard was associated only with a small surface

TABLE 1-1
SUMMARY OF POTENTIAL RISKS ASSOCIATED WITH THE DORNEY ROAD SITE
DORNEY ROAD RI

Exposure Scenario	Total Cancer Risks		Noncarcinogenic Hazard Index	
	Average	Plausible Maximum	Average	Plausible Maximum
Current Condition - Soil				
On-site Teenagers	2.39×10^{-8}	3.96×10^{-6}	<1	>1
On-site Adults	2.11×10^{-7}	3.19×10^{-5}	<1	>1
Current Conditions - Surface Water				
On-site Teenagers	NE	9.28×10^{-7}	<1	<1
On-site Adults	NE	1.68×10^{-5}	<1	<1
Current Conditions - Sediments				
On-site Teenagers	NA	1.19×10^{-10}	NA	<1
On-site Adults	NA	9.75×10^{-10}	NA	<1
Current Conditions - Leachate Seeps				
On-site Teenagers	NA	NA	NA	<1
On-site Adults	NA	NA	NA	<1
Current Conditions - Ground Water				
Residential Wells	7.14×10^{-6}	3.18×10^{-5}	<1	<1
Future Use - Soils				
Residents	8.51×10^{-7}	9.17×10^{-5}	<1	>1
Future Use - Ground Water				
On-site Wells	1.46×10^{-3}	9.61×10^{-3}	>1	>1
Future Use Ground Water				
Shallow Off-site	9.02×10^{-4}	4.23×10^{-3}	>1	>1
Future Use - Groundwater				
Deep Wells	1.47×10^{-4}	3.01×10^{-4}	<1	1
Future Use - Surface Soils				
On-site Workers	2.13×10^{-7}	1.97×10^{-5}	<1	>1
Future Use - Subsurface Soils				
On-site Workers	4.21×10^{-8}	8.83×10^{-3}	<1	<1

NA - Not Applicable
NE - Not Evaluated

ORIGINAL
(Red)

water feature located in the northwest portion of the site. Future-use scenarios that identified hazards associated with the site include dermal contact and incidental ingestion of soils by future site residents and the consumption of groundwater by both onsite and near site residents. The use of the risks identified in developing remedial response objectives to address the site are included in Section 3.0 of this report.

1.5 OVERVIEW OF REPORT

Section 1.0, INTRODUCTION, presents general information about the Dorney Road Landfill site from existing reports and studies. The current conditions of the site are presented through an explanation of the nature and extent of problems identified during the RI field activities. The objectives of the RI are detailed by each phase and activity.

Section 2.0, SITE-SPECIFIC Applicable or Relevant and Appropriate Requirements (ARARs) presents contaminant-specific and location-specific applicable or relevant and appropriate requirements (ARARs) that govern the extent of site remediation. The ARARs are considered in defining response objectives, establishing target cleanup levels, and developing remedial alternatives.

Section 3.0, IDENTIFICATION OF REMEDIAL RESPONSE OBJECTIVES identifies specific remedial response objectives to mitigate existing and future threats to public health and the environment at the site. Site-specific considerations and assumptions made in devising these objectives are highlighted.

Section 4.0, IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES identifies general response actions and technologies applicable to those response actions. Technical criteria used to screen the technologies include the ability to achieve reduction in mobility, toxicity, or volume; the ability to treat the wastes encountered at the landfill site (i.e., waste-limiting characteristics); and the implementability of the technology at the site (i.e., site-limiting characteristics).

Section 5.0, DEVELOPMENT OF REMEDIAL ALTERNATIVES, presents the remedial alternatives developed by combining the technologies identified as applicable to site problems by the screening process detailed in Section 4.0. The remedial alternatives developed follow the categories required by the Interim Guidance on Superfund Selection of Remedy (EPA Office of Solid Waste and Emergency Response (OSWER); Directive No. 9355.0-19; December 24, 1986).

Section 6.0, DETAILED EVALUATION OF ALTERNATIVES, contains the detailed analysis of each remedial alternative that was developed in Section 5.0. Introductory discussions define the detailed evaluation process. Alternatives are evaluated against effectiveness, implementability, and cost factors. In addition, the remedial alternatives are summarized and compared against each other with regard to effectiveness, implementability, and cost.

2.0 SITE-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

Section 121(d) of the Superfund Amendments and Reauthorization Act (SARA) and the National Contingency Plan (NCP) (40 CFR Part 300; November 20, 1985) require that Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) remedial actions comply with all Federal ARARs. State requirements must also be attained under Section 121(d)(2)(c) of SARA, if they are legally enforceable and consistently enforced statewide. ARARs are used to determine the appropriate extent of site cleanup, to scope and formulate remedial action alternatives, and to govern the implementation and operation of the selected action. According to SARA, requirements may be waived by EPA under six specific conditions, provided that protection of human health and the environment is still assured. These conditions include the following:

- The selected remedial action is an interim remedy or portion of a total remedy which will attain the standard when complete;
- Compliance with such requirements will result in greater risk to human health and the environment than alternative options;
- Compliance with such requirements is technically impracticable from an engineering perspective;
- The selected remedial action will provide an equivalent standard of performance using another approach;
- The requirement is a state requirement that has been inconsistently applied; and
- The alternative will not provide a balance between public health and environmental welfare and the availability of funds to respond to existing or potential threats at other sites, taking into account the relative immediacy of the threats.

In this section, the approach to identifying ARARs for the Dorney Road Landfill Site is discussed and ARARs for site-specific conditions are identified.

2.1 DEFINITION OF ARARs

A requirement under CERCLA as amended may be either "applicable" or "relevant and appropriate" to a site-specific remedial action, but not both.

Applicable Requirements: "Applicable requirements" are those cleanup standards, standards of control, or other substantive environmental protection requirements, criteria, or limitations that are generally enforceable under Federal or State law and specifically address a hazardous substance, remedial action, location, or other site-specific condition.

"Applicability" implies that the remedial action or circumstances at the site satisfy all the legal prerequisites for application if the action were not taken in conformance with Section 104 or 106 of CERCLA. An example of an applicable requirement would be Maximum Contaminants Levels (MCLs) for a site that causes contamination of a public water supply. ORIGINAL (Red)

Relevant and Appropriate Requirements: "Relevant and appropriate requirements" are Federal and State standards, criteria, or limitations that are not legally applicable to the site, yet they address problems sufficiently similar to those found on site that their use is well suited to the particular site. For example, while Resource Conservation and Recovery Act (RCRA) regulations are not applicable to closing undisturbed hazardous waste in place, the RCRA regulation for closure by capping may be deemed relevant and appropriate. During the FS process, relevant and appropriate requirements are intended to have the same weight and consideration as applicable requirements.

Other Requirements to be Considered: Federal and State guidance documents or criteria that are not generally enforceable but are advisory do not have the status of potential ARARs. Where no specific ARARs exist for a chemical or situation, or where such ARARs are not sufficient to be protective, guidance documents or advisories may be considered in determining the necessary level of cleanup for protection of health or environment.

2.2 TYPES OF ARARs

The ARAR requirements that Superfund actions may have to comply with are generally classified into three functional groups. These requirements include ARARs that are:

- o Chemical-specific (i.e., requirements that set protective cleanup levels for the chemicals of concern, or indicate an acceptable limit of discharge associated with a remedial action);
- o Location-specific (i.e., requirements that restrict remedial actions based on the characteristics of the site or its immediate environs); and
- o Action-specific (i.e., requirements that set controls or restrictions on the design, implementation, and performance levels of activities related to the management of hazardous substances, pollutants, or contaminants.

Chemical-specific requirements set health or risk-based concentration limits or ranges in various environmental media for specific hazardous substances. These requirements provide protective site cleanup levels or a basis for calculating cleanup levels for the chemicals of concern in the designated media. Chemical-specific ARARs are also used to indicate an acceptable level of discharge to determine treatment and disposal requirements that may occur in a remedial activity, and to assess the effectiveness of the remedial alternative. If a chemical has more than one such requirement, compliance with the more stringent ARAR should be performed. For instance, public water supply and surface water criteria and standards, as well as air quality standards, provide necessary cleanup goals for the Dorney Road Landfill Site.

Location-specific requirements set restrictions on the types of remedial activities that can be performed based on site-specific characteristics or location. Alternative remedial actions may be restricted or precluded based on Federal and State siting laws for hazardous waste facilities, proximity to wetlands or floodplains, or to manmade features such as existing landfills, disposal areas, and local historic buildings. These ARARs provide a basis for assessing restrictions during the formulation and evaluation of potential site-specific remedies. At the Dorney Road Landfill Site, currently no potential location-specific ARARs have been identified.

Action-specific requirements are triggered by the particular remedial activities that are selected to accomplish the cleanup. After remedial alternatives are developed, action-specific ARARs that specify performance levels, actions, or technologies, as well as specific levels for discharged or residual chemicals provide a basis for assessing the feasibility and effectiveness of the remedies. These action-specific ARARs may include, for example, hazardous waste transportation and handling requirements, air emission and water discharge standards, and the RCRA landfilling and treatment requirements.

2.3 CONSIDERATION OF ARARs

ARARs will be considered in two phases of this study. Phase I consists of the identification of chemical-specific and location-specific ARARs. These ARARs will be used during the identification of remedial response objectives, screening of technologies, and development and screening of remedial alternatives. An inventory of potential ARARs for each category was prepared to ensure that all ARARs were considered. The list of potential ARARs was narrowed based on whether the requirement is legally enforceable at the site or over site conditions, or whether it would be reasonable to apply the requirement to site conditions if the site or remedial actions were under its jurisdiction. This process was completed using checklists of potential ARARs and other requirements to be considered.

Phase II consists of the identification of action-specific ARARs that will control implementation and/or operation of remedial actions identified for the site, so that the feasibility and effectiveness of the remedy can be assessed. Potential action-specific ARARs will be identified in Section 2.4.3 and will be used in Section 5.0 to perform the initial screening of remedial alternatives. Section 6.0 will discuss action-specific ARARs in more detail in relation to specific alternatives, and will use them to conduct the detailed analysis of remedial alternatives.

2.4 IDENTIFICATION OF ARARs

Regulations identified as chemical- and location-specific ARARs for existing site conditions are presented in Sections 2.4.1 and 2.4.2, respectively. To be consistent with the NCP definition of ARARs and changes made by SARA, each section considered four separate categories, as follows:

- o Federal requirements (applicable, appropriate and relevant);
- o Pennsylvania requirements;
- o Federal criteria, advisories, and guidance documents; and

o Pennsylvania criteria, advisories, and guidance ORIGINAL (Red)

2.4.1 Chemical-Specific ARARs

Chemical-specific ARARs for the Dorney Road Landfill Site are identified in Table 2-1. In the discussion that follows, these ARARs are described by affected media requiring remediation (soils) or media that may receive discharges as a result of remedial action (i.e., surface water and air). Ground water ARARs will be identified in the final FS.

Surface Water: If a surface water treatment system is installed at the Dorney Road Landfill Site, the Clean Water Act (CWA), which governs discharges of priority pollutants into surface waters and establishes Federal Aquatic Water Quality Criteria (AWQC), is an ARAR for the Dorney Road Landfill Site. Such discharges will comply with the Federal CWA National Pollution Discharge Elimination System (NPDES) and Pennsylvania NPDES Permit Program Regulations. As stated in "Interim Guidance on Compliance with ARARs" (EPA, July 9, 1987), onsite actions such as surface water discharges need comply only with the substantive aspects of these requirements, not the administrative aspects. Therefore, although a discharge permit need not be obtained, the general requirements of a permit, including compliance with applicable water quality standards, must be met.

Surface water discharge requirements in Pennsylvania are determined on a case-by-case basis by the PADER. Pennsylvania Water Quality Criteria (25 Pa. Code §93.1 et. seq.) regulate dissolved oxygen, temperature increase, pH, turbidity, color and total coliform, and toxic or hazardous chemicals on a case-by-case basis through biological toxicity assessments with reference to the AWQC. Therefore, surface water discharge requirements for the Dorney Road Landfill Site will use AWQC for protection of fresh water aquatic life for guidance, before PADER's case-by-case requirements are determined.

Soils/Sediments: The Toxic Substances Control Act (TSCA) (40 CFR 761, Subpart G - Polychlorinated Biphenyls Spill Cleanup Policy) governs the cleanup standards for PCB spills. Because the policy establishes requirements for PCB spills that occur after the effective date of this policy (May 4, 1987) and because operations at the Dorney Road Landfill Site ceased in December, 1978, these requirements are not applicable but are relevant and appropriate to the site. As stated in an EPA memorandum, "Evaluation of TSCA Requirements as ARARs for the Re-Solve, Inc. Superfund Site," July 24, 1987, "spills that occurred before the effective date of this policy are to be decontaminated to requirements established at the discretion of EPA..."

In addition to the Spill Cleanup Policy, EPA promulgated the 1979 TSCA regulations for the storage and disposal and marking of materials containing PCBs greater than 50 ppm. Because the Dorney Road Landfill Site operations ceased prior to 1979, the PCB regulations are not applicable, but are relevant and appropriate to the disposal practices at the site. However, as the EPA memorandum states, "50 ppm...is not a public health-based standard, nor is it designed to attain complete protection of the environment. The establishment of this regulatory limit was based on economic and administrative

TABLE 2-1
CHEMICAL-SPECIFIC ARARS AND CRITERIA, ADVISORIES, AND GUIDANCE
DORNEY ROAD FEASIBILITY STUDY

MEDIUM/AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE RI/FS
Discharge to Surface Water				
State Regulatory Requirements	Pennsylvania Water Quality Standards	Applicable	PADER Water Quality Standards are given for dissolved oxygen, temperature increase, pH, and total Coliform.	Requirements for dissolved oxygen, temperature increase, pH and total Coliform will be attained however, limits are set on a case-by-case basis for contaminants found in the Dorney Road ground water which would be discharged to surface water, based on AWQC and bioassay results.
Federal Criteria, Advisories, and Guidance	Federal Ambient Water Quality Criteria (AWQC)	To be Considered	Federal AWQC are health-based criteria which have been developed for 95 carcinogenic and noncarcinogenic compounds.	AWQC were considered in characterizing human health risks to aquatic organisms due to contaminant concentrations in surface water. Because this water is not used as a drinking water source, the criteria is developed for aquatic organism protection and ingestion of contaminant aquatic organisms were considered. AWQC will be used for evaluating limits on all chemicals discharged to surface water.
Air				
Federal Regulatory Requirements	CAA-Natinal Air Quality Standards (NAQS) - 40 CFR 40.	Relevant and Appropriate	These standards were primarily developed to regulate stack and automobile emissions.	Standards for particulate matter will be used when assessing excavation and emission controls for soils treatments.
State Regulatory Requirements	PADER - Air Pollution Control Regulations	Relevant and Appropriate	These standards were primarily developed to regulate point source emissions.	Alternatives involving excavation and emission controls for soil treatments and incineration.
Federal Criteria Advisories, and Guidance	Threshold Limit Values (TLVs)	To be Considered	These standards were issued as consensus standards for controlling air quality in work place environments.	TLVs could be used for assessing site inhalation risks for soil removal operations.

considerations, as well as human health and the environment...(The 50 ppm standard) does not necessarily achieve the objective of Section 121 of CERCLA." The memorandum identifies health-based cleanup standards based on risk assessment as the appropriate cleanup level.

No Federal or Pennsylvania regulations specify soil concentration limits for PCB's or the other contaminants observed in soil at the site.

Air: Federal Primary and Secondary National Ambient Air Quality Standards (NAAQS) do not regulate volatile chemical emissions for the compounds present at the Dorney Road Landfill Site. Federal Ambient Air Quality Standards for particulate matter do exist and are applicable when evaluating remedial alternatives with air emissions.

Pennsylvania air regulations promulgated under the Air Pollution Control Act are applicable to the evaluation of air emissions associated with remedial actions at the site. These regulations include requirements for fugitive emissions, particulate matter, sulfur dioxide, odor, and visible emissions (25 Pa. Code §§123.1 et. seq.) and ambient air quality standards (25 Pa. Code §§131.1 et. seq.). The Pennsylvania ambient air quality standards address settled particulate, beryllium, sulfates, fluorides, and hydrogen sulfide which are not included in Federal ambient air quality standards.

Pennsylvania's "Interim Operating Guidance for Air Toxic Substances" provides a consistent procedure and chronic (annual) low level exposure air quality guidelines for assessing the potential for public health hazards from new and modified sources that emit toxic substances. This guidance will be considered in the evaluation of source air emissions associated with remedial actions at the site.

2.4.2 Location-Specific ARARs

Location-specific ARARs for the Dorney Road Landfill Site are identified in Table 2-2. While the site itself does not contain any regulated physical features (i.e., wetlands, floodplains), site remediation potentially may include actions in floodplains such as discharge pipes from water treatment units, or disruption of wilderness or wildlife refuge areas by the removal of the onsite ponds.

Wetlands/Floodplains: Executive Order 11988 (40 CFR 6, Appendix A-Protection of Floodplains) is to be considered for remedial actions that may be located in floodplains, i.e., lowlands, and relatively flat areas adjoining inland waters and other flood prone areas. Potentially applicable requirements are the RCRA Location Standards (40 CFR 264.18b) for treatment, storage, or disposal facilities located in a 100-year floodplain.

Under Federal law, the CWA (40 CFR, Section 404) and the Fish and Wildlife Coordination Act regulate activity in the vicinity of wetlands. The CWA requires that effects on wetlands be evaluated and no activity that adversely affects a wetland be permitted if a practicable alternative that has less effect is available. The Fish and Wildlife Coordination Act requires that the

TABLE 2-2
LOCATION-SPECIFIC ARARS AND CRITERIA, ADVISORIES, AND GUIDANCE
DORNEY ROAD FEASIBILITY STUDY

MEDIUM/AUTHORITY	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE RI/FS
At the current time, no potential location-specific ARARs have been identified. The site is not: - A wetland - Within a flood plain - Within 100 year flood plain - In a wilderness area - A wildlife refuge - Within an area affecting a national wild, scenic, or recreational river - A critical habitat upon which endangered or threatened species depends				
However, remedial actions may potentially include activities involving the following location-specific ARARs:				
<u>Floodplains</u>				
Federal Regulatory Requirements	Fish and Wildlife Coordination Act (16 U.S.C. 661)	Applicable	This regulation requires that any Federal Agency that proposes to modify a body of water or potentially affect fish and wildlife Services. This requirement is addressed under CWA Section 404 requirements.	During the identification, screening, and evaluation of alternatives, the effects on streams and wetlands are evaluated. If an alternative modifies a body of water or potentially affects fuel or wildlife, EPA must consult the U. S. Fish and Wildlife Service.
	RCRA Location Standards (40 CFR 264.18)	Applicable	This regulation outlines the requirements for constructing a RCRA facilility on a 100-year floodplain.	A facility located on a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout or any hazardous waste by a 100-year flood, unless waste may be removed safely before floodwater can reach the facility or no adverse effects on human health and the environment would result if washout occurred.
Federal Nonregulatory Requirements to be Considered	Executive Order 11988 Protection of Floodplains (40 CFR6, Appendix A)	To be Considered	Under this regulation, Federal agencies are required to avoid adverse effects, minimize potential harm, restore and preserve the natural and beneficial values of of floodplains.	Remedial alternatives that involve construction in floodplain areas must include all practicable means of minimizing harm. Floodplain protection considerations must be incorporated into the planning and decision-making about remedial alternatives.
State Regulatory Requirements	PADER - Dam and Waterways Act (25 PA Code §§105.1 <u>et. seq.</u>)	Applicable	This regulation establishes provisions regulating construction activities which obstruct, or encroach on streams or wetlands within the State.	Remedial alternatives that involve construction in floodplain or wetland areas.

U.S. Fish and Wildlife Services be consulted before a body of water is modified.

Another location-specific ARAR is the Pennsylvania hazardous waste facility siting regulation (Subchapter F - 25 Pa. Code §§75.401 - 405) that provides criteria for siting hazardous waste treatment and disposal facilities. Although CERCLA remedial actions are exempt from these regulations, the requirements are still relevant and appropriate since a new facility for treatment and/or disposal of hazardous waste may be constructed. The Pennsylavnia hazardous waste facility siting regulations identifies areas where a facility would not be permitted (e.g., wetlands), and criteria which identify environmental, social, and economic factors which may affect the suitability of the site. As stated in "Interim Guidance on Compliance with ARARs" (EPA, July, 1987), CERCLA Section 121(d)(2)(c) puts special limits on the applicability of State siting laws for hazardous waste facilities that could result in a statewide prohibition on land disposal. Specifically, to be treated as an ARAR, the law must meet the following requirements:

- o Generally applicable and formally adopted;
- o Based on technical (e.g., hydrogeologic) or other relevant considerations; and
- o Not intended to preclude land disposal for reasons other than protection of health or the environment.

At the Dorney Road Landfill Site, the Pennsylvania Hazardous Waste Facility Siting Regulation is relevant and appropriate. Specifically, no portion of a facility may be located within a wetland or bordering a vegetated wetland, or within a 100-year floodplain, unless approved by the State.

Chapter 105 (25 Pa. Code §§105.1 <u>et. seq.</u>) establishes provisions regulating the construction of dams, reservoirs, water obstructions, encroachments, and wetlands in the Commonwealth. These regulations may be applied to remedial actions involving construction within floodplain or wetland areas.

2.4.3 <u>Action-Specific ARARs</u>

Regulations identified as potential ARARs for possible remedial alternatives are presented in Table 2-3. Major requirements that must be attained are discussed in the following brief descriptions. Action-specific ARARs for each remedial alternative that passes the initial screening are discussed in more detail in Section 6.0, Detailed Analysis of Remedial Alternatives.

<u>RCRA Subtitle C</u>: Many RCRA Subtitle C requirements apply because: 1) the Dorney Road Landfill Site contains RCRA-listed hazardous waste; and 2) the proposed remedial technologies will generally constitute treatment, storage, or disposal.

RCRA Part 264 requirements that must be instituted for remedial alternatives that involve construction of onsite treatment, storage, or disposal facilities include: 1) standards for owners and operators of permitted hazardous waste

TABLE 2-3
POTENTIAL ACTION-SPECIFIC ARARS
DORNEY ROAD FEASIBILITY STUDY

Action(s)	ARARs	Status	Requirement Synopsis
All	Superfund Amendments and Reauthorization Act (SARA)	Applicable	One of the main requirements of SARA is that the EPA should pursue permanent remedial solutions (destruction, detoxification, or treatment of hazardous substances) whenever possible.
All	OSHA - General Industry Standards (29 CFR 1910)	Applicable	These regulations specify the 8-hr. time-weighted average concentration for various organic compounds. Training requirements for workers at hazardous waste operations are specified in 29 CFR 9910.120.
All	OSHA - Safety and Health Standards (29 CFR 1926)	Applicable	This regulation specifies the type of safety equipment and procedures to be followed during site remediation.
All	Resource Conservation and Recovery Act (RCRA), RCRA Subtitle C, 40 CFR 260	Applicable	RCRA regulates the generation, transport, storage, treatment, and disposal of hazardous waste. CERCLA specifically requires (in Section 104(c)(3)(B)) that hazardous substances from removal actions be disposed of at facilities in compliance with Subtitle C of RCRA.
All	OSHA - Record keeping, Reporting, and Related Regulations (29 CFR 1904)	Applicable	This regulation outlines the record keeping and reporting requirements for an employer under OSHA.
All	Intergovernmental Review of Federal Program. Executive Order 12372 and 40 CFR 29 (replaces state and area-wide coordination process required by OMB Circular A-95).	Applicable	Requires state and local coordination and review of proposed EPA assisted projects. The EPA Administrator is required to communicate with State and local officials to explain the project, consult with other affected Federal agencies, and provide a comment period for state review.
All	USEPA Ground Water Protection Strategy - USEPA Policy Statement, August 1984	To be Considered	Identifies ground water quality to be achieved during remedial actions based on the aquifer characteristics and use.
All	RCRA - Standards for Owners Operators of Permitted Hazardous Waste Facilities (40 CFR 264.10 - 264.8)	Relevant and Appropriate	General facility requirements outline general waste analysis, security measures, inspections, and training requirements.
	PASWR - New and Existing Hazardous Waste Management Facilities Applying for a Permit (PA Code, Title 25, 75.264(a)-(g))	Relevant and Appropriate	General facility requirements outline general waste analysis, security measures, inspections, and training requirements.
All	RCRA - Preparedness and Prevention (40 CFR 264.30 - 264.31).	Relevant and Appropriate	This regulation outlines requirements for safety equipment and spill control.

Action(s)	ARARs	Status	Requirement Synopsis
All	PASWR - Preparedness and Prevention (25 PA Code, 75.264(1.))	Relevant and Appropriate	This regulation outlines requirements for safety equipment and spill control.
All	RCRA - Contingency Plan and Emergency Procedures (40 CFR 264.50 - 264.56)	Relevant and Appropriate	This regulation outlines the requirements for emergency procedures to be used following explosions, fires, etc.
All	PASWR (PPC) - Preparedness, Prevention and Contingency (PPC) Plan and Emergency Procedures (25 PA Code, 75.264(i))	Relevant and Appropriate	This regulation outlines the requirements for emergency procedures to be used following explosions, fires, etc.
All	RCRA - Ground Water Protection (40 CFR 264.90 - 264.109)	Relevant and Appropriate	This regulation details requirements for a ground water monitoring program to be installed at the site.
All	PASWR - Ground Water Monitoring (25 PA Code, 75.264(u))	Relevant and Appropriate	This regulation details requirements for a groundwater monitoring program to be installed at the site.
All	RCRA - Closure and Post Closure (40 CFR 264.110 - 264.120)	Relevant and Appropriate	This regulation details specific requirements for closure and post-closure of hazardous waste facilities.
All	PASWR - Closure and Post-Closure (25 PA Code, 75.264(o))	Relevant and Appropriate	This regulation details specific requirements for the closure and post-closure of hazardous waste facilities.
Capping-Waste In Place	RCRA - Landfills (40 CFR 264.310(a))	Relevant and Appropriate	Placement of a cap over waste requires a cover designed and constructed to: o Provide long-term minimization of migration of liquids through the capped area; o Function with minimum maintenance; o Promote drainage and minimize erosion or abrasion of the cover; o Accommodate settling and subsidence so that the cover's integrity is maintained o Have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present.
	RCRA - Landfills (40 CFR 264.310(a)))	Relevant and Appropriate	Prevent run-on and run-off from damaging cover.

ORIGINAL (Red)

Table 2-3
Dorney Road FS
Page 3

Action(s)	ARARs	Status	Requirement Synopsis
Clean Closure (Removal)	RCRA - General Standards (40 CFR 264.111)	Relevant and Appropriate	General performance standard requires minimization of need for further maintenance and control; minimization or elimination of post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products. Also requires disposal or decontamination of equipment, structures and soils.
	RCRA - Manifesting, Record-keeping and Reporting	Applicable	This regulation specifies the recordkeeping and reporting requirements for RCRA facilities.
Closure with Waste In-Place (Hybrid Closure)	Proposed Rule 52 FR 8712 (March 19, 1987)	To be Considered	Requires removal of majority of contaminated materials. Also requires application of cover and post-closure monitoring based on exposure pathway(s) of concern.
	RCRA - Manifesting, Record-keeping and Reporting (40 CFR 264.70 - 264.77)	Applicable	This regulation specifies the record keeping and reporting requirements for RCRA facilities.
Ground Water and Surface Water Monitoring	RCRA - Ground Water Protection (40 CFR 264.97)	For Ground Water: Relevant and Appropriate for Surface Water: To be Considered	General requirements for ground water monitoring.
Construction and Operation of Onsite Landfill	RCRA - Landfills (40 CFR 264, Subpart N)	Relevant and Appropriate	Regulates the design, construction, operation and closure of hazardous waste landfill.
	RCRA Land Ban (40 CFR 268, Subpart D)	Applicable	After 11/8/88, placement on or in land outside unit boundary or area of contamination will trigger land disposal requirements and restrictions. Also requires treatment by Best Demonstrated Available Technology (BDAT) before placement.
	Hazardous and Solid Waste Amendments of 1984 (1984 Amendments to RCRA) PL 98-616, Federal Law 71:3101	Relevant and Appropriate	Specific wastes are prohibited from land disposal under the 1984 RCRA Amendments. This includes a ban on the placement of wastes containing free liquids. Also, solvent-containing wastes are prohibited from land disposal, effective November, 1986. EPA is also required to set treatment levels or methods, exempting treated hazardous wastes from the land disposal ban. To date, these treatment standards have not been promulgated. The RCRA amendments will also restrict the landfilling of most RCRA-listed wastes by 1991 unless treatment standards are specified.
	PASWR - Landfills (25 PA Code, 75.264(v))	Relevant and Appropriate	This regulation details liner and cap construction requirements, and surface water controls.
Construction and Operation of Onsite Incinerator	RCRA - Incinerators (40 CFR 264, Subpart O)	Relevant and Appropriate	Regulates the design, construction, operation and closure of hazardous waste incinerators.
	PASWR - Incinerators (25 PA Code, 75.264(w))	Relevant and Appropriate	Regulates the design, construction, and operation of hazardous waste incinerators.

Action(s)	ARARs	Status	Requirement Synopsis
	RCRA - (40 CFR 761.70)	Relevant and Appropriate	Lists special performance standards for incineration of PCBs.
	Clean Air Act (CAA) National Ambient Air Quality Standards (NAAQS) (440 CFR 1 to 99)	Relevant and Appropriate	Applies to major stationary sources such as treatment units that have the potential to emit significant amounts of pollutants such as NO_x, SO2, CO, lead, mercury and particulates (more than 250 tons/year). Regulations under CAA do not specifically regulate emissions from hazardous waste incinerators, but it is likely that Prevent of Significant Deterioration (PSD) provisions would apply to an onsite treatment facility.
	Interim RCRA/CERCLA Guidance of Non-Contiguous Sites and Onsite Management of Waste and Treated Residue (USEPA Policy Statement March 27, 1986)	To be Considered	If a treatment of storage unit is to be constructed for onsite remedial action, there should be a clear intent to dismantle, remove, or close the unit after the CERCLA action is completed. Should there be plans to accept commercial waste at the facility after the CERCLA waste has been processed, it is EPA policy that a RCRA permit be obtained before the unit is constructed.
	PADER Interim Operations Guidance for Air Toxic Substances	To be Considered	Guidelines for assessing the potential for public health hazards from new and modified sources that emit toxic substances.
Onsite Water Treatment and Discharge	National Pollution Discharge Elimination System (NPDES) (40 CFR 122)	Relevant and Appropriate	Regulates the discharge of water into public surface waters. Among other things, major requirements are: o Use of best available technology (BAT) economically achievable is required to control toxic and nonconventional pollutants. Use of best conventional pollutant control technology (BCT) is required to control conventional pollutants. Technology-based limitations may be determined on a case-by-case basis. o Applicable Federally approved State water quality standards must be complied with. These standards may be in addition to or more stringent than other Federal standards under the CWA. o The discharge must conform to applicable water quality requirements when the discharge affects a state other than the certifying state. o The discharge must be consistent with the requirements of a Water Quality Management Plan approved by EPA. o Discharge limitations must be established for all toxic pollutants that are or may be discharged at levels greater than that which can be achieved by technology-based standards. o Discharge must be monitored to assure compliance. Discharger will monitor: · The mass of each pollutant. · The volume of effluent. · Frequency of discharge and other measurements as appropriate. o Approved test methods for waste constituents to be monitored must be followed. Detailed requirements for analytical procedures and quality controls are provided. o Approved test methods for waste constituents to be monitored must be followed. Detailed requirements for analytical procedures and quality controls are provided.

ORIGINAL (Red)

Action(s)	ARARs	Status	Requirement Synopsis
			o Permit application information must be submitted, including a description of activities, listing of environmental permits, etc. Onsite discharges to surface waters are exempt from procedural NPDES permit requirements. (Section 121 of SARA exempts onsite CERCLA activities from obtaining permits. However, the substantive requirements of the permit must be met). Offsite discharges would be required to apply for and obtain an NPDES permit. o Monitor and report results as required by permit (minimum of at least annually). o Comply with additional permit conditions such as: · Duty to mitigate any adverse effects of any discharge; and · Proper operation and maintenance of treatment systems.
	Proposed Standards for Control of Emissions of Volatile Organics - 52 FR 3748 (February 5, 1987)	To be Considered	Prescribes proposed standards for VOC emissions from units such as air strippers.
	PADER Interim Operations Guidance for Air Toxic Substances	To be Considered	Guidelines for assessing the potential for public health hazards from new and modified sources that emit toxic substances.
	Toxic Pollutant Effluent Standards (40 CFR 129)	Relevant and Appropriate	Regulates the discharge of the following pollutants: aldrin/dieldrin, DDT, endrin, toxaphene, benzidine, and PCBs.
	Fish and Wildlife Coordination USC661 et. seq.	Applicable	This act requires that before undertaking any Federal action that causes the Act 16 modification of any body of water or affects fish and wildlife, the following agencies must be consulted: the appropriate State agency exercising jurisdiction over Wildlife Resources and the U. S. Fish and Wildlife Service.
	PADER Chapter 92 (25 PA Code §§95.1 et. seq.)	To be Considered	Waste treatment requirements for all dischargers including procedures for discharges to lakes, ponds, and impoundments.
Offsite Discharge to POTW	Clean Water Act (CWA) (40 CFR 403)	Applicable	These regulations control the discharge of contaminated water to POTW. The same regulations apply regardless of whether remedial action discharges into the sewer of trucks waste to POTW. Point of reference is entry of pollutants into treatment system as the POTW. Some of the major requirements of these regulations are: o Pollutants that pass through the POTW without treatment, interfere with POTW operation, or contaminate POTW sludge are prohibited. o Specific prohibitions preclude the discharge of pollutants to POTWs that: · Create a fire or explosion hazard in the POTW; · Are corrosive (pH < 5.0): · Are discharged at a flow rate and/or concentration that will result in interference; · Increase the temperature of wastewater entering the treatment plant that would result in interference, but in no case raise the POTW influent temperature above 104 degrees F (40 degrees C).

Action(s)	ARARs	Status	Requirement Synopsis
			o If a leachate collection system is installed and the discharge is sent to a POTW, the POTW must have an approved pretreatment program. The collected leachate runoff must be in compliance with the approved program. Prior to discharging, a report must be submitted containing identifying information, list of approved permits, description of operations, flow measurements, measurement of pollutants, certification by a qualified professional, and a compliance schedule.
	RCRA - General Standards (40 CFR 264.71 and 264.72)	Relevant and Appropriate	RCRA permit-by-rule requirements must be complied with for discharges of RCRA hazardous wastes to POTWs by truck, rail, or dedicated pipe.
Excavation	CAA - NAAQS for Total Suspended Particulates (40 CFR 129.105, 750)	Relevant and Appropriate	This regulation specifies maximum primary and secondary 24 hour concentrations for particulate matter. Fugitive dust emissions from site excavation activities must be maintained below 260 ug/m^3 (primary standard).
	Land Ban (40 CFR 268 - Subpart D)	Applicable	After November 8, 1988, movement of excavated materials to new location and placement in or on land will trigger land disposal restrictions.
Excavation	PADER Chapter 102 (25 PA Code §§102.1 et. seq.)	Applicable	Requires control of soil erosion and sedimentation from earthmoving activities.
	PADER - Air Pollution Control Act	Relevant and Appropriate	Regulates the emissions from stationary air emission sources. Includes control of a wider range of emissions than the NAAQS.

ORIGINAL
(Red)

facilities; 2) preparedness and prevention; 3) contingency plan and emergency procedures; 4) recordkeeping and reporting; and 5) ground water monitoring. In addition, all remedial alternatives must meet RCRA closure and post-closure requirements which would be applicable to onsite remedial actions.

RCRA Part 264, provides three basic closure options, the requirements of which are appropriate and relevant for CERCLA remedial actions. The clean closure option requires removal or decontamination of all hazardous constituents, and it includes very stringent ground water standards. If all hazardous constituents will not be removed or decontaminated, the landfill closure option may be used. Landfill closure is a containment option and requires a final cover or cap and a post-closure plan that protects human health and the environment. The third closure option, alternative closure, is a hybrid between clean closure and landfill closure requirements, and will go into effect in November 1988. Alternate closure allows wastes to remain at the site and does not require a full-closure program or an impermeable cap. The requirements for alternative closure are based on eliminating site-specific exposure pathways. Therefore, the potential for direct contact and the potential for leachate contamination of ground water would be required to be eliminated.

For remedial alternatives that involve transportation, treatment, storage, and/or disposal of hazardous wastes, RCRA Subtitle C disposal requirements (including the Land Disposal Restriction) will be an ARAR. The Hazardous and Solid Waste Amendments (HSWA) amendments prohibit the continued land disposal of hazardous wastes beyond specified dates unless EPA determines, based on a case-specific petition, that there will be "no migration" of hazardous constituents from the disposal unit or injection zone for as long as the wastes remain hazardous. After November 8, 1988, movement of certain specified excavated hazardous materials to new locations and placement in or on land will trigger land disposal restrictions. Wastes treated in accordance with the treatment standards set by EPA pursuant to RCRA Section 3004(m) are not subject to the prohibitions and may be land-disposed.

Land disposal restrictions for certain "California List" hazardous wastes apply to liquid wastes containing PCBs greater than or equal to 50 ppm and other liquid and non-liquid hazardous wastes containing hazardous organic chemicals greater than or equal to 1,000 mg/kg. Therefore, these restrictions do not apply to the Dorney Road Landfill Site groundwater, surface water, soil, sediment or waste. However, land disposal restrictions for solvent-containing wastes apply to wastes containing specific halogenated and non-halogenated solvents (F001 to F005 wastes), and therefore do apply to Dorney Road Landfill Site soils. When these wastes are removed, disturbed, or physically altered during remedial action, "Land Ban" requires that the wastes be treated to "Best Demonstrated Available Technology" (BDAT) levels before the wastes can be placed or replaced on land. BDAT requires levels or methods of treatment which substantially diminish the toxicity of the waste or substantially reduce the likelihood of migration of hazardous constituents from the waste so that short-term and long-term threats to human health and the environment are minimized. "Land Ban" also prohibits storage of hazardous wastes, except for accumulation to facilitate recovery, treatment, or disposal. "Land Ban" is relevant and appropriate since the regulations are

(Red)

scheduled to be phased-in over a number of years. Currently, CERCLA actions that involve solvent-contaminated wastes are exempt from these regulations until November 8, 1988; however, remedial alternatives for the Dorney Road Landfill Site will comply with "Land Ban," and solvent-containing waste will be treated by BDAT.

Clean Water Act: Several regulations promulgated under the CWA apply when considering remedial alternatives that involve dredging, ground water treatment, and discharges to surface water. Although onsite CERCLA actions do not require permits, the NPDES permit requirements for point-source discharges must be met, including the NPDES Best Management Practice Program. These regulations include, but are not limited to, requirements for compliance with water quality standards, a discharge monitoring system, and records maintenance.

Clean Air Act (CAA): Requirements concerning alternatives that involve excavation and air emissions from treatment facilities include the National Air Quality Standards for Total Suspended Particulates under the CAA. The specific standards are presented in Table 2-3.

Occupational Safety and Health Act (OSHA): Federal OSHA requirements that regulate worker safety and employee records must be followed during all site work. These regulations include safety and health standards for Federal service contracts and recordkeeping, reporting, and related regulations.

Fish and Wildlife Coordination Act: For proposed discharges to surface water, the Fish and Wildlife Coordination Act applies, requiring EPA to notify various Federal agencies of the proposed action.

Pennsylvania Regulatory Requirements: In addition to Federal ARARs, several Pennsylvania regulations apply to potential remedial alternatives. The specific requirements are presented in Table 2-3. These regulations include:

- Subchapter C (25 Pa. Code §§75.259 - 75.282) which is consistent with RCRA, and provides a comprehensive program for the identification, handling, transportation, and recordkeeping of hazardous waste. These regulations will be either applicable or relevant and appropriate if they are more stringent than corresponding Federal requirements.

- Chapter 92 (25 Pa. Code §§91.1 et. seq.) which is consistent with the National Pollutant Discharge Elimination System (NPDES) Program and regulates discharges to Pennsylvania surface waters. Remedial alternatives involving discharge to surface waters must comply with the substantive aspects of these requirements, if they are more stringent that the corresponding Federal requirements.

- Chapter 95 (25 Pa. Code §§95.1 et. seq.) which sets forth waste treatment requirements for all dischargers including procedures for dealing with discharges to lakes, ponds, and impoundments.

- Chapter 102 (25 Pa. Code §§102.1 et. seq.) establishes requirements for the control of soil erosion and sedimentation resulting from earthmoving activities and would apply to remedial actions involving earth disturbance.

- Regulations promulgated under the Pennsylvania Air Pollution Control Act including 25 Pa. Code §§127.1 et. seq. ,§§135.1 et. seq., §§139.1 et. seq., and §§139.1 et. seq.. These regulations may need to be substantively met if a remedial alternative involves air stripping or other air emission from a stationary source.

Pennsylvania Guidance Documents: Numerous guidance documents have been prepared by the Commonwealth of Pennsylvania for facilitating compliance with state regulations. These guidance documents will be considered where appropriate in the evaluation of remedial alternatives.

3.0 IDENTIFICATION OF REMEDIAL ACTION OBJECTIVES

In this section, remedial response objectives based on public health and environmental considerations are developed to support the development and analysis of remedial alternatives. The results of the public health evaluations summarized in the Dorney Road RI form the basis for identifying these objectives. The response objectives are media-specific goals for those media selected for remediation in the FS and are directed toward the site landfill proper. Response actions are developed using considerations presented in the National Contingency Plan (NCP) in 40 CFR 300.68 (e)(2) and in the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) Section 121 as amended. Target levels for cleanup of contaminated media are developed based on guidelines presented in EPA (1986a,b). These target levels are based solely on health considerations.

3.1 GENERAL RESPONSE OBJECTIVES

The conclusions of the Public Health Evaluation (PHE) for the Dorney Road Landfill Site indicated that several potential exposure pathways may pose significant risks of concern to public health and the environment under certain assumed exposure conditions. For the purposes of this document a target risk considered for remedial action is defined as an excess lifetime cancer risk of greater than 10^{-6}, or, for noncarcinogenic chemicals, a hazard index greater than one. This is in accordance with the most recent ARAR guidance, as cited in the PHE. An excess lifetime cancer risk is the upper-bound probability that an individual exposed to a given level of a chemical will, over a lifetime, develop cancer. EPA guidance recommends development of cleanup goals in the target excess lifetime cancer risk range of 10^{-4} to 10^{-7}. A 10^{-6} excess lifetime cancer risk, for example, is a one in one million (1/1,000,000 or 10^{-6}) chance that the exposed individual will develop cancer. As an upper-bound estimate, the actual risk is not likely to exceed the risk level, and may be lower. A hazard index is the sum of the ratios of the chronic daily intake (CDI) to the reference dose (RfD) for each noncarcinogenic chemical; where the CDI represents the average daily dose of the chemical received by the individual, and the RfD represents a daily exposure which is likely to be without an appreciable risk of deleterious effects during a lifetime. Therefore, a hazard index greater than 1 would indicate the daily intake exceeds the value not expected to present adverse effects, and the potential exists for adverse health effects. For current site conditions, the pathways of concern are:

- Direct contact (incidental ingestion and dermal absorption) with contaminated surface soils by trespassing by hunting teenagers and/or adults.
- Direct contact (incidental ingestion and dermal absorption) with contaminated surface water in the drainage feature located in the northwest portion of the site; and
- Ingestion of contaminated groundwater by nearby offsite residents.

ORIGINAL
(Red)

Based on the PHE conclusions, exposure pathways which may pose significant risks in the future are:

- o Direct contact (incidental ingestion and dermal absorption) with contaminated surface soils by children and adults living in all areas of the site;

- o Direct contact (incidental ingestion and dermal absorption) with contaminated soils during extended construction periods by the construction workers; and

- o Ingestion of contaminated groundwater by either onsite or nearby offsite residents.

The results of the PHE previously identified were used to develop remedial response objectives to mitigate potential current and future threats to public health and the environment. For this FS, the objectives of remedial action were narrowed to address only the direct contact hazards as specified by PADER. A supplemental FS will address the groundwater hazards associated with the site. However, one goal of all remedial actions evaluated during this FS will be that they not hinder future groundwater remediation methods. Actions that mitigate groundwater hazards while also mitigating direct hazards will be evaluated more favorably.

The remedial response objectives for the Dorney Road site are:

1. Prevent direct contact (incidental ingestion and dermal absorption) with contaminated soils (and solid wastes) throughout the site by trespassers, hunters, residents and construction workers;

2. Prevent direct contact (incidental ingestion and dermal absorption) with contaminated surface water located in the northwest portion of the site; and

3. Implement no actions that could interfere with future groundwater remediation.

Response objectives must also consider the attainment of chemical-specific and location-specific applicable or relevant and appropriate requirements (ARARs) and other guidance for existing and potential future site conditions in certain media. ARARs are selected by EPA on a site-by-site basis taking into account the requirements of the Superfund Amendments and Reauthorization Act (SARA) and site-specific factors such as groundwater usage and classification.

Cleanup levels, which are solely toxicologically based, were developed to support the response objectives outlined above and are discussed in detail in the following section. It should be noted that no adverse impacts to either aquatic or terrestrial wildlife were identified in the endangerment assessment.

3.2 CLEANUP LEVELS

Cleanup levels were developed for the Dorney Road Landfill site during preparation of the Public Health Evaluation. Table 3-1 shows standards and criteria for surface water and Tables 3-2 through 3-4 show concentrations of indicator chemicals in surface soils at which certain standards, criteria, and risks will not be exceeded. The cleanup levels in soil are developed using the residential current and future use scenario and are based on lifetime exposure through direct contact and incidental ingestion of surface soil. These cleanup levels are derived using the same methodology that was used to estimate risk in the public health evaluation (PHE). For carcinogens, exposures resulting in upperbound lifetime excess cancer target risk levels of 10^{-4}, 10^{-5}, 10^{-6} and 10^{-7} are evaluated. This carcinogenic risk range was selected for evaluation based on Section 9.2 of the Superfund Public Health Evaluation Manual (USEPA, October, 1986). For noncarcinogens, the exposure equivalent to a chronic daily intake/risk reference dose ratio of 1 is evaluated. The chronic daily intakes associated with these target risk levels are used to derive the cleanup concentrations in soil by back calculation from the health effects criteria presented in Section 6 of the Dorney Road RI.

The assumptions used in determining target cleanup levels for soil at the site under the hypothetical future residential use scenario are presented in detail in Section 6.4.5 of the RI. Some general assumptions follow.

Direct contact with soil under both current and future use scenarios is comprised of both a dermal absorption pathway and an incidental soil ingestion pathway.

Under the current use scenario, the Dorney Road site is used for recreational purposes only. The area is used primarily for hunting. It was assumed that both teenagers and adults would use the area for hunting and consequently two sets of assumptions, an average case and a maximum plausible case, were developed for both teenagers and adults.

For the future use scenario, it was assumed that the landfill area has been converted to residential use. It was assumed that a person would live in the area until the age of 18 (average case) or would reside in the area for their entire lifetime (maximum plausible case).

Cleanup levels for surface soil and subsurface soils that would be protective of groundwater were also estimated. Under this scenario, it was assumed that groundwater was used as a residential source of drinking water and that chemicals present in the soil and subsurface soil have the potential to leach from these soils into groundwater. Cleanup levels in soil represent the concentration of a particular chemical that, should it leach to groundwater and subsequently be ingested as drinking water, would not result in an excess human cancer risk of 1×10^{-6} or a chronic daily intake to Reference dose ratio of 1. These cleanup levels are presented in Table 3-5 and 3-6.

Table 3-1
Comparison of Surface Water Concentrations with Applicable or Relevant and Appropriate Standards Established by the EPA (1986a)
Dorney Road FS

Chemical	ARARs (ug/l) MCL	ARARs (ug/l) MCLG	Residential Water (ug/l) Mean[a]	Residential Water (ug/l) Maximum	Groundwater (On-site) (ug/l) Mean[a]	Groundwater (On-site) (ug/l) Maximum	Surface Water (ug/l) Mean[a]	Surface Water (ug/l) Maximum
Organics:								
Benzene	5[b]	---	---	---	5.16	14	---	---
Bis(2-ethylhexyl)-phthalate	---	---	NA	2	13.80	40	---	---
1,1-dichloroethane	---	---	NA	2	---	---	NA	9
1,2-dichloroethylene	---	70[b]	---	---	---	---	---	---
Diethyl phthalate	---	---	---	---	8.43	20	---	---
Ethylbenzene	---	680[b]	---	---	107.9	160	NA	3
Styrene	---	140[b]	---	---	NA	43	---	---
Tetrachloroethylene	---	---	---	---	NA	1	---	---
Toluene	---	2000[b]	---	---	160.6	740	NA	8
Trichloroethylene	5[b]	---	NA	9	---	---	---	---
Vinyl Chloride	1[b]	---	---	---	6.23	25	---	---
Xylenes	---	440[b]	---	---	305.70	530	---	---
Inorganics:								
Arsenic	50	---	---	---	12.9	140	NA	1.7
Barium	1000	---	13.30	31	767.7	3480	71.8	580
Beryllium	---	---	---	---	4.6	22	---	---
Cadmium	10	---	---	---	5.8	19	---	---
Chromium	50	---	---	---	38.0	72	6.5	9.95
Copper	---	1300[b]	---	---	50.7	218	---	---
Lead	50	---	---	---	627.1	11900	8.8	30
Manganese	---	---	6.50	83	11080.0	420000	1083.0	31000
Mercury	2	---	---	---	0.27	0.64	---	---
Nickel[c]	---	---	---	---	684	3540	---	---
Zinc	---	---	26.43	448	4165	37700	19.1	34

[a]Geometric mean.
[b]EPA proposed MCLs and MCLGs (EPA, 1986a).
[c]Neither adopted nor proposed MCL or MCLGs were available; however, the EPA Drinking Water Health Advisory for Nickel in a 70 kg human, exposed over a lifetime is 350 ug/l.
NA = not applicable. Only detected in one sample, and use of one-half of the detection limit in calculating the mean results in a mean concentration that is less than the detection limit.

Table 3-2

Cleanup Levels Based on Residential Exposure
of Teenegers to Indicator Chemicals Present In Surface Soil
Dorney Road FS

Chemical	Surface Soil Concentration in mg/kg Based on Chronic Intake/Risk Reference Dose Ratio of 1.0		Surface Soil Concentrations in mg/kg Based on Upperbound Lifetime Cancer Risks			
	Average	Maximum	Risk 10E-7	Risk 10E-6	Risk 10E-5	Risk 10E-4
PAHs	NA	NA	1.32E+00	1.32E+01	1.32E+02	1.32E+03
PCB	NA	NA	2.17E+00	2.17E+01	2.17E+02	2.17E+03
Arsenic	NA	NA	5.72E+01	5.72E+02	5.72E+03	5.72E+04
Benzene	NA	NA	1.65E+02	1.65E+03	1.65E+04	1.65E+05
Chloroform	NA	NA	1.06E+02	1.06E+03	1.06E+04	1.06E+05
Bis(ethylhexyl)phthalate	NA	NA	1.25E+04	1.25E+05	1.25E+06	1.25E+07
Dieldrin	NA	NA	2.77E-01	2.77E+00	2.77E+01	2.77E+02
Bis(ethylhexyl)phthalate	8.46E+00	1.23E-01	NA	NA	NA	NA
Di-N-butylphthalate	4.23E+01	6.13E-01	NA	NA	NA	NA
Phenol	4.23E+01	6.13E-01	NA	NA	NA	NA
4-Methylpentanone	2.12E+01	3.06E-01	NA	NA	NA	NA
Chlorobenzene	1.14E+01	1.66E-01	NA	NA	NA	NA
Ethylbenzene	4.23E+01	6.13E-01	NA	NA	NA	NA
4-Methylphenol	2.12E+01	3.06E-01	NA	NA	NA	NA
Beryllium	2.11E-01	3.07E-03	NA	NA	NA	NA
Chromium	2.12E+00	3.07E-02	NA	NA	NA	NA
Copper	1.69E+01	2.45E-01	NA	NA	NA	NA
Lead	5.92E-01	8.58E-03	NA	NA	NA	NA
Mercury	8.46E-01	1.23E-02	NA	NA	NA	NA
Nickel	4.23E+00	6.13E-02	NA	NA	NA	NA
Zinc	8.88E+01	1.29E+00	NA	NA	NA	NA
Naphthalene	1.73E+01	2.51E-01	NA	NA	NA	NA

NA = not applicable. Only detected in one sample, and use of one-half of the detection limit in calculating the mean results in a mean concentration that is less than the detection limit.

Table 3-3

Cleanup Levels Based on Residential Exposure
of Adults to Indicator Chemicals Present in Surface Soil
Dorney Road FS

Chemical	Surface Soil Concentration in mg/kg Based on Chronic Intake/Risk Reference Dose Ratio of 1.0		Surface Soil Concentrations in mg/kg Based on Upperbound Lifetime Cancer Risks			
	Average	Maximum	Risk 10E-7	Risk 10E-6	Risk 10E-5	Risk 10E-4
PAHs	NA	NA	1.64E-01	1.64E+00	1.64E+01	1.64E+02
PCB	NA	NA	2.70E-01	2.70E+00	2.70E+01	2.70E+02
Arsenic	NA	NA	7.07E+00	7.07E+01	7.07E+02	7.07E+03
Benzene	NA	NA	2.04E+01	2.04E+02	2.04E+03	2.04E+04
Chloroform	NA	NA	1.31E+01	1.31E+02	1.31E+03	1.31E+04
Bis(ethylhexyl)phthalate	NA	NA	1.55E+03	1.55E+04	1.55E+05	1.55E+06
Dieldrin	NA	NA	NE	NE	NE	NE
Bis(ethylhexyl)phthalate	3.78E+00	1.55E-01	NA	NA	NA	NA
Di-N-butylphthalate	1.89E+01	7.74E-01	NA	NA	NA	NA
Phenol	1.89E+01	7.74E-01	NA	NA	NA	NA
4-Methylpentanone	9.45E+00	3.87E-01	NA	NA	NA	NA
Chlorobenzene	5.10E+00	2.09E-01	NA	NA	NA	NA
Ethylbenzene	1.89E+01	7.74E-01	NA	NA	NA	NA
4-Methylphenol	9.45E+00	3.87E-01	NA	NA	NA	NA
Beryllium	9.45E-02	3.87E-03	NA	NA	NA	NA
Chromium	9.45E-01	3.87E-02	NA	NA	NA	NA
Copper	7.56E+00	3.10E-01	NA	NA	NA	NA
Lead	2.65E-01	1.08E-02	NA	NA	NA	NA
Mercury	3.78E-01	1.55E-02	NA	NA	NA	NA
Nickel	1.89E+00	7.74E-02	NA	NA	NA	NA
Zinc	3.97E+01	1.63E+00	NA	NA	NA	NA
Naphthalene	7.75E+00	3.17E-01	NA	NA	NA	NA

NA = not applicable. Only detected in one sample, and use of one-half of the detection limit in calculating the mean results in a mean concentration that is less than the detection limit.

NE = not evaluated.

ORIGINAL (Red)

Table 3-4

Cleanup Levels Based on Residential Exposure
to Indicator Chemicals in Future Surface Soil
Dorney Road FS

Chemical	Surface Soil Concentration in mg/kg Based on Chronic Intake/Risk Reference Dose Ratio of 1.0		Surface Soil Concentrations in mg/kg Based on Upperbound Lifetime Cancer Risks			
	Average	Maximum	Risk 10E-4	Risk 10E-5	Risk 10E-6	Risk 10E-7
PAHs	NA	NA	1.47E+03	1.47E+02	1.47E+01	1.47E+00
PCB	NA	NA	2.41E+03	2.41E+02	2.41E+01	2.41E+00
Arsenic	NA	NA	6.87E+04	6.87E+03	6.87E+02	6.87E+01
Benzene	NA	NA	1.98E+05	1.98E+04	1.98E+03	1.98E+02
Chloroform	NA	NA	1.27E+05	1.27E+04	1.27E+03	1.27E+02
Bis(ethylhexyl)phthalate	NA	NA	1.51E+07	1.51E+06	1.51E+05	1.51E+04
Bis(ethylhexyl)phthalate	5.92E+00	3.08E-01	NA	NA	NA	NA
Diethylphthalate	3.85E+03	2.00E+02	NA	NA	NA	NA
Phenol	2.96E+01	1.54E+00	NA	NA	NA	NA
4-Methylpentanone	1.48E+01	7.70E-01	NA	NA	NA	NA
Chlorobenzene	7.99E+00	4.16E-01	NA	NA	NA	NA
Ethylbenzene	2.96E+01	1.54E+00	NA	NA	NA	NA
4-Methylphenol	1.48E+01	7.70E-01	NA	NA	NA	NA
N-Nitrosodiphenylamine	0.00E+00	0.00E+00	NA	NA	NA	NA
Naphthylene	0.00E+00	0.00E+00	NA	NA	NA	NA
Beryllium	1.48E-01	7.70E-03	NA	NA	NA	NA
Chromium	1.48E+00	7.70E-02	NA	NA	NA	NA
Copper	1.18E+01	6.16E-01	NA	NA	NA	NA
Lead	4.14E-01	2.16E-02	NA	NA	NA	NA
Mercury	5.92E-01	3.08E-02	NA	NA	NA	NA
Nickel	2.96E+00	1.54E-01	NA	NA	NA	NA
Zinc	6.22E+01	3.23E+00	NA	NA	NA	NA
Naphthalene	1.21E+01	6.31E-01	NA	NA	NA	NA

NA = not applicable. Only detected in one sample, and use of one-half of the detection limit in calculating the mean results in a mean concentration that is less than the detection limit.

Table 3-5

Cleanup Levels Based on Lifetime Residential
Exposure to Indicator Chemicals in Groundwater
Dorney Road FS

Chemical	Surface Soil Concentration in mg/kg Based on Chronic Intake/Risk Reference Dose Ratio of 1.0	Surface Soil Concentrations in mg/kg Based on Upperbound Lifetime Cancer Risks			
		Risk 10E-7	Risk 10E-6	Risk 10E-5	Risk 10E-4
PAHs	NA	5.20E-01	5.20E+00	5.20E+01	5.20E+02
PCB	NA	8.283-02	8.28E-01	8.28E+00	8.28E+01
Benzene	NA	6.90E-02	6.90E-01	6.90E+00	6.90E+01
Chloroform	NA	4.36E-02	4.36E-01	4.36E+00	4.36E+01
Diethylphthalate	4.75E+05	NA	NA	NA	NA
Phenol	3.52E+03	NA	NA	NA	NA
Chlorobenzene	1.04E+03	NA	NA	NA	NA
Ethylbenzene	4.70E+03	NA	NA	NA	NA

NA = not applicable. Only detected in one sample, and use of one-half of the detection limit in calculating the mean results in a mean concentration that is less than the detection limit.

ORIGINAL (Red)

000708

Table 3-6

Cleanup Levels Based on Lifetime Residential
Exposure to Indicator Chemicals in Groundwater
Dorney Road FS

Chemical	Surface Soil Concentration in mg/kg Based on Chronic Intake/Risk Reference Dose Ratio of 1.0	Surface Soil Concentrations in mg/kg Based on Upperbound Lifetime Cancer Risks			
		Risk 10E-7	Risk 10E-6	Risk 10E-5	Risk 10E-4
PAHs	NA	5.20E-01	5.20E+00	5.20E+01	5.20E+02
Benzene	NA	6.90E-02	6.90E-01	6.90E+00	6.90E+01
Chloroform	NA	4.36E-02	4.36E-01	4.36E+00	4.36E+01
1,2-Dichloroethane	NA	3.86E-02	3.86E-01	3.86E+00	3.86E+01
Tetrachloroethene	NA	7.63E-02	7.63E-01	7.63E+00	7.63E+01
Diethylphthalate	4.75E+05	NA	NA	NA	NA
Phenol	3.52E+03	NA	NA	NA	NA
Ethylbenzene	4.70E+03	NA	NA	NA	NA
Toluene	1.15E+04	NA	NA	NA	NA
Xylenes (total)	3.76E+02	NA	NA	NA	NA
Di-n-butylphthalate	1.88E+05	NA	NA	NA	NA

NA = not applicable. Only detected in one sample, and use of one-half of the detection limit in calculating the mean results in a mean concentration that is less than the detection limit.

The soil cleanup levels were developed to aid in the selection of general response actions and applicable technologies. An attempt was made to use various levels of risk (i.e., from 10^{-4} to 10^{-7}) to delineate potential "hot spot" areas of the site on which to focus remediation. For reasons explained in detail in Section 5.0, a "hot spot" scenario could not be developed. The major reason precluding a "hot spot" scenario was the inconsistent levels and locations of contaminants that were encountered randomly at all areas of the site. The highest concentration of one fraction (i.e., VOA, BNA, etc.) in surface soils did not match up well with subsurface soil or shallow landfill groundwater contamination. The conclusion was reached that the site consists of numerous pockets of waste or disposal areas that vary widely over the site. As a result, no "hot spot" delineation based on cleanup levels was able to be determined and all removal and treatment scenarios addressed the entire waste volume.

3.3 CONSIDERATIONS OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

The response objectives for the Dorney Road site must consider attainment of ARARs. As previously noted in Section 2, there are no ARARs available for soils while ARARs are available for surface water. The supplemental FS will consider ARARs for groundwater. The ARARs for surface water are presented in Table 3-1. For the soil target levels determined in Section 3.2 (based on protection for ingestion of groundwater contaminants by chemicals in potable aquifers which exceed the typical groundwater MCLs presented on Table 3-1.

4.0 IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES

The purpose of this section is to identify remedial actions and corresponding technologies which can be assembled into comprehensive remedial alternatives capable of achieving the Remedial Response Objectives developed in the preceding section. General response actions are first identified to define several general strategies for site remediation. Remedial technologies corresponding to each of the general response actions are then identified and evaluated for their effectiveness and implementability at the site. Technologies retained through the screening process will be subsequently assembled into a range of remedial alternatives addressing each of the Remedial Response Objectives.

4.1 IDENTIFICATION OF GENERAL RESPONSE ACTIONS

General response actions are broad classes of responses or remedies intended to meet the remedial action objectives set for the site as identified in Section 3.0. Each general response action defines a specific approach to remediation of the onsite contamination. While response actions are presented as separate, stand-alone remediation strategies, two or more may be used in combination to provide a more comprehensive approach to site clean-up. Such an example would be the use of a treatment action to reduce toxicity and volume of contaminated material, combined with a containment action to reduce the mobility of residual contaminants in the treatment product. The following response actions have been identified to meet the Remedial Response Objectives:

- Minimal/No Action: Implementation of institutional actions and other indirect methods of reducing exposure to site hazards.
- Containment: Physical isolation of contaminated media to minimize potential exposure and reduce migration of contaminants to groundwater.
- Removal: Physical removal of contaminated media.
- Disposal: Placement of contaminated media or treatment residue into secure, permanent storage. Removal action will also be required in conjunction with disposal.
- Treatment: Alteration of contaminated media to destroy, remove, or immobilize contaminants. Removal action and/or disposal action may be required in conjunction with treatment.

4.2 IDENTIFICATION OF REMEDIAL TECHNOLOGIES

Potentially applicable remedial technologies identified to address each of the five response action categories presented in Section 4.1 are listed in Table 4-1. These remedial technologies will address only hazards associated with contaminated solid wastes, soils and surface water. The only surface water to be addressed is one small pond located in the northwest portion of the site.

TABLE 4-1

POTENTIALLY APPLICABLE REMEDIAL TECHNOLOGIES
DORNEY ROAD FEASIBILITY STUDY

ORIGINAL (Red)

RESPONSE ACTION	TECHNOLOGY
Minimal/No Action	None Site Fencing Deed Restrictions
Containment	Soil Cover Asphalt Cap Concrete Cap Multi-Layer Cap Regrading Runon/Runoff Controls
Removal	Excavation Bulk Liquid Removal
Disposal	Onsite RCRA Landfill Offsite RCRA Landfill Deep Well Injection Discharge to Surface Water
Treatment	Soil Vapor Extraction Vitrification Biological Treatment Water or Solvent Leaching Supercritical Fluid Extraction Low-Temperature Thermal Aeration Oxidation/Reduction Ultrasonic/Ultraviolet Treatment Solidification/Fixation Onsite Incineration Offsite Incineration POTW Water Treatment Private RCRA Facility Water Treatment On-site Water Treatment

ANCILLARY ACTION	TECHNOLOGY
Monitoring	Runoff Monitoring Groundwater Monitoring
Landfill Gas Discharge	Passive Vents Active Vents

Additional technologies are identified to fulfill several ancillary action categories which would be required in conjunction with response actions. Ancillary actions do not perform a primary function in site remediation, but are necessary for proper implementation of response action technologies. The following ancillary actions have been identified:

- **Monitoring**: Monitoring of contaminant levels in media leaving the site to detect potential contaminant migration would be necessary with the implementation of any action.

- **Landfill Gas Discharge**: Since the site is a municipal landfill which produces methane gas, containment actions must include a method for venting the trapped gas.

Thirty-two technologies identified as being potentially applicable to the site and addressing the response actions or the ancillary actions are presented in Table 4-1.

4.3 SCREENING OF REMEDIAL TECHNOLOGIES

The remedial technologies identified in Section 4.2 are screened in this section to identify a set of technologies for use in assembling remedial alternatives. The screening process is based on the following criteria:

- **Effectiveness**: The ability of each technology to effectively attain the given response action is assessed based on the site-specific conditions. Technologies which will not effectively achieve the desired goal due to the nature of the site and site contaminants will be eliminated.

- **Implementability**: Technologies will also be evaluated to determine whether they can be adequately implemented based on acceptable engineering practices and administrative considerations.

Relative cost will also be used, to a limited extent, to evaluate technologies which offer similar effectiveness and implementability in addressing the same response action. A technology may be eliminated if there exists another technology addressing the same response action that is equally feasible and beneficial but less costly. It can not be used to differentiate between treatment and non-treatment technologies.

The screening process is intended to identify those technologies that are most appropriate to attain the remedial action objectives, given the site conditions. This screening process considers major effects and does not necessarily rely on quantification to identify and eliminate less feasible technologies.

Table 4-2 presents the results of technology screening, while additional discussion and justification are provided in the following subsections.

TABLE 4-2
INITIAL SCREENING OF TECHNOLOGIES FOR SUITABILITY
DORNEY ROAD FEASIBILITY STUDY

RESPONSE ACTION: Technology	Description	Effectiveness	Implementability	Status
NO-ACTION		Risks are identified in the Endangerment Assessment	--	Retained for further consideration, as required by SARA.
MINIMAL NO-ACTION: Site Fencing	Often constructed of steel chainlink with barbed wire and used to enclose a specified area. Restricts but does not totally eliminate site access.	-Reliability is dependent on future maintenance. -Protective by reducing risk of direct contact with contaminated soil and wastes. -Does not reduce TMV.	-Easily implemented. -Routinely used. -Periodic inspection and maintenance required.	Retained for further consideration.
MINIMAL NO-ACTION: Deed Restrictions	All deeds for property within potentially contaminated areas would include restrictions on the use of the property.	-Protective by reducing risk of direct contact with contaminated soil, sediment and wastes. -Reliability is dependent upon implementation in the future. -Does not reduce TMV. -Effectiveness may be questionable.	-Easily implemented. -Enforcement may be difficult.	Retained for further consideration.
CONTAINMENT: Soil Cover	Contain contaminated solids by covering with a layer of low permeability soil and revegetating.	-Reduces mobility of contaminants and risk of direct contact; however, contaminants remain onsite. -Soil layer may crack, however cracks can heal themselves.	-Construction is relatively easy. -Requires periodic maintenance due to potential for cracking and erosion of cover material. -Does not satisfy RCRA.	Retained as means of reducing exposure to surface contaminants at low cost.

ORIGINAL (Red)

TABLE 4-2 (Continued)

RESPONSE ACTION: Technology	Description	Effectiveness	Implementability	Status
CONTAINMENT: Asphalt Cap	Contain by covering contaminated solids with a layer of asphalt.	-Reduces mobility of contaminants and risk of direct contact; however, contaminants remain on site. -Does not satisfy RCRA. -Asphalt cap may crack, leading to potential exposures, may be unreliable.	-Construction is relatively easy. -Needs periodic maintenance since there is a potential for cracking due to freeze-thaw cycles. -Potentially incompatible with site contaminants.	Eliminated due to potential for cracking and incompatibility with site wastes. Multi-layer cap performs same function more effectively.
CONTAINMENT: Concrete Cap	Contain contaminated solids by covering with a layer of reinforced concrete.	-Reduces mobility of contaminants and risk of direct contact; however, contaminants remain onsite. -Does not satisfy RCRA. -Concrete susceptible to cracking due to frequent freeze-thaw cycles, leading to potential exposures; may be unreliable.	-Construction is relatively easy. -Needs periodic maintenance since there is a potential for cracking due to freeze-thaw cycles.	Eliminated due to potential for cracking. Multi-layer cap performs same function more effectively and at lower cost.
CONTAINMENT: Multi-Layer Cap	Combines several layers of cover materials such as soil, synthetic membranes, and clay to provide erosion and moisture control, in addition to containing the contaminated solids.	-Reduces mobility of contaminants and risk of direct contact; however, contaminants remain on site. -Meets RCRA requirements. -Multilayer system is reliable since cracking is minimized. -Clay layer is self healing if cracked.	-Construction requires multiple steps and is time consuming. -Periodic maintenance required, but less substantial then with single-layer cap.	Retained for further consideration. Provides most effective containment with relatively low maintenance.
CONTAINMENT: Regrading	The site surface would be regraded to eliminate depressions and provide positive drainage.	-Reduces surface water retention and erosion, thus reducing potential migration of solid media contamination. -Necessary, for implementation of other containment options.	-Common site construction techniques would be employed.	Retained.

ORIGINAL (Red)

TABLE 4-2 (Continued)

RESPONSE ACTION: Technology	Description	Effectiveness	Implementability	Status
CONTAINMENT: Runon/Runoff Controls	A dike would be constructed around the site to prevent runon, and runoff would be diverted to a sediment pond prior to discharge.	-Reduces sediment load to receiving drainage. -Reduces migration of contaminated sediment from site. -Necessary for implementation of other containment options.	-Common site construction techniques would be employed.	Retained
REMOVAL: Excavation	Contaminated solids would be removed with common construction equipment.	-Effective at removing contaminated solids. -Required for subsequent treatment/disposal. -Will not reduce volume or toxicity of contaminated solids. -Removal could cause volatilization of organics.	-Technically feasible. -Can be done using common construction equipment. -Complete or partial excavation of contaminated zones may be feasible.	Retained for combination with treatment and disposal actions.
REMOVAL: Bulk Liquid Removal	Ponded surface water would be pumped dry. Water would be discharged, treated or disposed.	-Eliminates contaminated surface water. -Water may require subsequent treatment/disposal. -Toxicity or volume of contaminated water is not reduced.	-Easily implemented using standard pumping techniques.	Retained.
DISPOSAL: Onsite RCRA Landfill	Soils and wastes from contaminated areas are excavated and disposed in a RCRA-approved facility constructed on site.	-Reliable method to contain wastes. -Volume or toxicity of waste is not reduced. -Protective by reducing direct exposure to contaminated materials. -Without treatment, does not meet requirements of SARA. -Without treatment, may trigger "land-ban."	-Water-saturated materials would require either chemical solidification or mechanical dewatering prior to landfilling. -Readily constructable. However, construction involves considerable effort, continued maintenance, and long-term monitoring. -Potential long-term liability for waste remaining on site.	Retained for further consideration, although the use of landfills is discouraged under SARA.

ORIGINAL (Red)

TABLE 4-2 (Continued)

RESPONSE ACTION: Technology	Description	Effectiveness	Implementability	Status
DISPOSAL: Offsite RCRA Landfill	Wastes are excavated, transported, and disposed at a RCRA-approved offsite facility.	-Reliable method to contain wastes. -Volume or toxicity of waste is not reduced. -Protective by reducing direct exposure to contaminated materials. -Without treatment, does not meet requirements of SARA. -Without treatment, may trigger "land-ban." -Volatilization of organics during transportation could pose a health hazard.	-Water-saturated soils would require either chemical solidification or mechanical dewatering prior to landfilling. -Implementable. Requires excavation and transportation. -Potential long-term liability for waste placed in landfill. -Offsite landfill would require trucking of a large quantity of contaminated material, which may not be administratively feasible. -Offsite landfill capacity is limited.	Eliminated as onsite RCRA landfill will perform same function at much lower cost.
DISPOSAL: Deep Well Injection	Pond water is pumped and hauled to a RCRA-approved facility and injected into a well. The well must extend below the lowest formation containing and underground source of drinking water.	-Permanently disposes of contaminated water. -Isolates contamination from public, but does not affect toxicity or volume. -Contrary to SARA treatment/destruction mandate.	-Not easily implemented due to lack of accepting deep wells in the area. -Administratively undesirable since waste water not treated.	Eliminated due to lack of available facilities in the area.
DISPOSAL: Discharge to Surface Water	Ponds are drained and discharged to the adjacent surface waters without any form of treatment.	-Only applicable if contaminant levels are low enough to meet ARARs. -Does not reduce TMV of contaminated water.	-Selection of this remedial technology would require demonstration that environmental effects to surface water ecosystems are minimal. -Difficult to obtain administrative approval.	Retained.

715

ORIGINAL (Red)

TABLE 4-2 (Continued)

RESPONSE ACTION: Technology	Description	Effectiveness	Implementability	Status
TREATMENT: Soil Vapor Extraction	The process involves the in-situ air stripping of contaminated soils using a vacuum source. The technology volatilizes and removes some contaminants directly from the vadose zone.	-Vacuum extraction is effective for removing some VOCS from the vadose zone only. Other site contaminants unaffected. -Volatilized organics may pose a health risk in ambient air. -Subsequent process needed to destroy other organic contaminants of concern.	-Although considered innovative, most components of the system are relatively simple to construct. -Heterogeneous nature of waste would lead to uneven removal of contaminants from solid media.	Eliminated due to implementation difficulties and limited effectiveness. VOC contamination is of limited concern; significant health risks are associated with BNA and inorganic contamination.
TREATMENT: Vitrification	Electrodes inserted into soils and waste containing significant levels of silicates. Graphite is placed on the soil surface to connect the electrodes. The heat generated from this system causes a melt that gradually works downward through the soil. Inorganics and some organics are trapped in the melted silicates that cool to a form of obsidian (i.e., very strong glass). Other organics are destroyed in process.	-Highly effective in reducing toxicity, mobility and volume of contaminants. -Destroys organic contaminants and binds up all other contaminants in glass-like mass. -Unproven in large-scale applications at hazardous waste sites.	-Not implementable for soils with greater than 5% total organic content. -Silica content of municipal waste is too low to yield a vitrified treatment product.	Eliminated. Landfill waste contains much greater than 5% organic material and insufficient silica.

TABLE 4-2 (Continued)

RESPONSE ACTION: Technology	Description	Effectiveness	Implementability	Status
TREATMENT: Biological Treatment	Compositing, the most applicable biological treatment for solid waste with high organics contents, consists of placing waste in piles in which temperature, pH, oxygen content, moisture content, nutrient content, and other parameters can be controlled. Naturally occurring or introduced micro-organisms degrade organic constituents.	-Reduces toxicity by degrading contaminants. -Produces leachate which requires further treatment. -Bench and pilot scale study required to determine level of contaminant reduction. -Relatively long treatment duration.	-Method relies on standard earthmoving techniques. -Significant odors may be generated. -May be difficult to identify and maintain microorganisms to function in the range of contaminants present-particularly heavy metals.	Eliminated due to implementability difficulties caused by multi-contaminent environment.
TREATMENT: Water or Solvent Leaching	Leaching of contaminants from solids is achieved by contacting adequately processed solids with a solvent that will remove the soluble fraction of contaminants from the solid. May be performed in situ, or in a reactor after excavation.	-If implementable, could be used to effectively extract contaminants from solid media. -Reduces volume of contamination in solid media, but produces large volume of contaminated extraction fluid. -May increase mobility of contaminants if implemented in situ. -Bench and pilot tests required to determine if acceptable levels of contaminant removal can be achieved.	-Difficult to recover extraction solvents if implemented in situ. -Leaching in a reactor would require excavation of contaminated solids. -Spent leaching fluids would require additional treatment. -Implementation would be difficult with multi-contaminant environment present at the site.	Eliminated due to implementation difficulties.

..717

TABLE 4-2 (Continued)

RESPONSE ACTION: Technology	Description	Effectiveness	Implementability	Status
TREATMENT: Supercritical Fluid Extraction	Fluids at their critical point are used to extract organics from excavated soils. Process used in laboratory and industry to remove organics, including PCBs.	-Reduces volume of contaminants in solid media, but produces concentrated contaminant solution requiring treatment or disposal. -Achievable level of contaminant removal may not be sufficient to attain action levels.	-May be difficult to implement in multicontaminant environment present on site. -Availability and implementation problematic due to experimental nature. -Would require excavation of contaminated solids.	Eliminated. Still in experimental phase of development. Multi-contaminant environment may preclude its use.
TREATMENT: Low-Temperature Thermal Aeration	Volatile and some semi-volatile organic wastes are removed from the soil by introducing heated air into a reactor with the soil to strip contamination from soil. Soil excavation is required for treatment.	-Reduces volume of contaminants in solid media. -Has been demonstrated at other hazardous waste sites to remove certain organics from soils. -Not proven and not likely to remove PCBs, PAHs and other non-volatile contaminants. -Volatilized organics may pose a health risk in ambient air.	-Implementable. Could be constructed on site or preassembled mobile units could be transported to the site. -Would require excavation of contaminated solids.	Eliminated. Other treatment technologies, such as incineration, deal with all organics. Questionable effectiveness in removing PAHs to target risk levels. Does not address inorganics.
TREATMENT: Oxidation/Reduction	Oxidation consists of a detoxification process that oxidizes some organic and inorganic contaminants. During reduction, certain forms of inorganics are reduced to less toxic forms.	-Oxidation is effective on a small number of organic and inorganic contaminants. -Reduction may reduce toxicity of inorganics.	-Multi-contaminant materials are inappropriate for chemical methods due to potential for side reactions producing toxic or explosive compounds. -Oxidation is not well suited for high-strength complex waste streams. -Pilot studies required.	Eliminated because site conditions (multi-contaminant setting) preclude its use.

TABLE 4-2 (Continued)

RESPONSE ACTION: Technology	Description	Effectiveness	Implementability	Status
TREATMENT: Ultrasonic/Ultraviolet Treatment	Contaminated solids are fed as a slurry into a mixing tank, where ozone is added and the mixture is simultaneously exposed to ultra-violet radiation and ultra-sonic energy. The ultra-sonic energy aids in extraction of PCBs from the solids, and UV/ozone irradiation results in destruction of PCBs and other organics.	-This technology may destroy PCBs and other organics associated with solids. -Unreliable: unproven effectiveness in treating multi-contaminant environments. -May not achieve target cleanup levels. -Reduces toxicity of contaminants.	-Availability of process is limited, as it is still in its experimental stages. -Pilot study would be required.	Eliminated due to its unproven effectiveness and uncertainty relative to achievement of target cleanup levels.
TREATMENT: Solidification and Fixation	Consists of transforming excavated contaminated solids into a non-leachable form or creating a material which is easier to handle.	-Can effectively reduce mobility of inorganics. -May not be effective for soils containing VOCs. -Pilot test required to evaluate reduction in mobility. -Does not reduce the volume or toxicity of contaminated material.	-Cannot be effectively implemented on municipal waste due to high organic content. -Immobilized waste volume may be increased.	Eliminated due to implementation difficulties.
TREATMENT: Onsite Incineration	Two types of onsite incinerators are available: rotary kiln and infrared systems. In rotary kiln incineration, waste and auxiliary fuel are fed through a refractory-lined rotating chamber where they are completely combusted. In infrared incineration, the energy required for combustion is supplied by resistance elements in the incineration chamber rather than by the addition of fuel.	-Reduces toxicity, mobility, and volume. -Performance data for incineration technologies are well-demonstrated with high efficiency for destroying wastes. Will achieve target levels. -Onsite incineration does not have well-demonstrated reliability. Has been implemented on a small number of hazardous waste sites.	-Mobile and transportable units are available for onsite incineration. -Onsite incineration requires permitting. -Ash from onsite incineration must be delisted or placed in RCRA vault. -Would require excavation of solid waste.	Retained for further consideration.

ORIGINAL (Red)

TABLE 4-2 (Continued)

RESPONSE ACTION: Technology	Description	Effectiveness	Implementability	Status
TREATMENT: Offsite Incineration	Transport solid waste to a permitted hazardous waste incineration facility.	-Reduces toxicity, mobility and volume. -Performance data for incineration are well-demonstrated with high efficiency for destroying wastes. Will achieve target levels. -Performance data are reliable.	-Currently approximately four operating facilities are located in the U.S. All four facilities are running at capacity. Capacity is therefore limited. -Excavation, drumming, loading, and transportation of waste would be necessary.	Eliminated. Onsite thermal treatment performs same function at significantly lower cost.
TREATMENT: POTW Water Treatment	Contaminated surface water would be pumped and hauled by tank truck to a local POTW for treatment.	-Effective for removal of organics from aqueous waste stream, provided POTW has proper capabilities for waste stream.	-Technically easy to implement. -Unlikely that POTW facility will agree to accept Superfund waste due to liability.	Eliminated due to difficulty in getting POTW to accept Superfund waste water.
TREATMENT: Private RCRA Facility Water Treatment	Contaminated surface water would be pumped and hauled by tank truck for disposal at a treatment facility licensed to handle organic and inorganic wastes.	-Effective for removal of organics from aqueous waste stream.	-Implementability dependent on locating suitable treatment facility a reasonable distance from the site.	Retained.
TREATMENT: Onsite Water Treatment	A mobile treatment unit consisting of carbon adsorption or air stripping units would be brought onsite to treat contaminated surface water.	-Effective for removal of organics from aqueous waste streams. -Eliminates need for water transportation to treatment facility.	-Relatively easy to implement. -Some pilot or bench scale testing may be required.	Eliminated. RCRA facility treatment would be equally effective and less costly due to small quantity to be treated (approximately 5,000 gallons of contaminated water on site).

TABLE 4-2 (Continued)

RESPONSE ACTION: Technology	Description	Effectiveness	Implementability	Status
ANCILLARY ACTIONS				
MONITORING: Runoff Monitoring	Sample and analyze surface water and sediment leaving the site.	-Detects migration of solid waste contaminants to surface water and sediment. -Can be used to indicate failure of an implemental remedial technology or need for additional action.	-Standard water sampling and sediment sampling techniques would be used to obtain periodic samples from all points where surface water flows from the site.	Retained
MONITORING: Groundwater Monitoring	Sample and analyze groundwater both upgradient and downgradient from the site.	-Detects migration of solid waste contaminants to ground water. -Can be used to indicate failure of an implemental remedial technology or need for additional action.	-Periodic samples would be obtained from existing wells or monitoring wells constructed for this purpose.	Retained
LANDFILL GAS DISCHARGE: Passive Vents	Consists of free venting vertical wells or cutoff barrier trenches to vent gases from discharging areas.	-Allows efficient discharge of confined gas beneath a containment layer.	-Relatively simple construction in most instances. -Simple to add treatment units to most systems, if necessary.	Retained for further consideration in conjunction with containment technologies.
LANDFILL GAS DISCHARGE: Active Vents	Same venting structures as passive vents with the addition of a suction source to positively draw gas out of landfill.	-Allows efficient discharge of confined gas beneath a containment layer. -Prevent pressure build up beneath containment layer which could result in migration of gas.	- Relatively simple construction in most instances. -Simple to add treatment units to most systems, if necessary. -Requires operation and maintenance.	Eliminated. Passive vents should provide sufficient venting at lower cost.

4.3.1 Minimal/No Action

ORIGINAL (Red)

Site Fencing: A perimeter fence provides an easily implemented method of reducing pedestrian and animal traffic across the site, thus decreasing exposure to site contaminants. Frequent inspection and maintenance is required to maintain the integrity of the fence. While applicable by itself, site fencing would also be desirable in conjunction with other site actions. Fencing will be retained for consideration in developing remedial alternatives.

Deed Restrictions: Deed restrictions place legal limitations on future property use. These restrictions would prohibit future uses of the property that could result in increased exposure to or migration of site contaminants (e.g. prohibit use of the site for residential development). Deed restrictions can be easily implemented. However, their effectiveness is dependent upon continued enforcement which is uncertain. Deed restrictions will be retained for consideration in developing remedial alternatives.

4.3.2 Containment

Containment technologies minimize the dermal contact and incidental ingestion exposure pathways by placing a continuous physical barrier over the contaminated solids. Because the physical barrier reduces or eliminates infiltration of precipitation, migration of contaminants from the solid media to groundwater may also be reduced by the containment layer. Four applicable containment technologies have been identified and an evaluation of the effectiveness and implementability of each follow:

Soil Cover: A soil cover consists of a compacted clean soil layer overlain by a vegetative layer which covers the contaminated solids. The effectiveness of the soil cover is dependent upon continual inspection and maintenance, as erosion and cracking are likely to occur. Due to the plastic nature of soil, however, minor cracks may tend to close themselves and a relatively large amount of subsidence can be tolerated. Construction would be relatively easy and inexpensive, utilizing standard site construction techniques. Administrative approval may be difficult to obtain as the soil cover does not satisfy the requirements of RCRA for final cover of landfills. The soil cover technology will be retained as a low-cost means of providing a containment action.

Asphalt Cap: Asphaltic concrete is employed as a containment layer over contaminated solids. The surface is durable and impermeable, however, continual inspection and maintenance are required to repair cracking caused by landfill subsidence and natural freeze/thaw cycles. The asphaltic cap is more susceptible to cracking than the soil cover due to the material's stiffer nature, and thus provides a lower degree of reliability. Construction would be relatively simple employing basic road construction techniques, however, administrative approval may be difficult to obtain since RCRA requirements are not satisfied. An additional consideration is the cost, which is significantly greater than that for soil cover. The asphalt cap technology will be eliminated from further consideration since soil cover performs the same function with greater reliability and at lower cost.

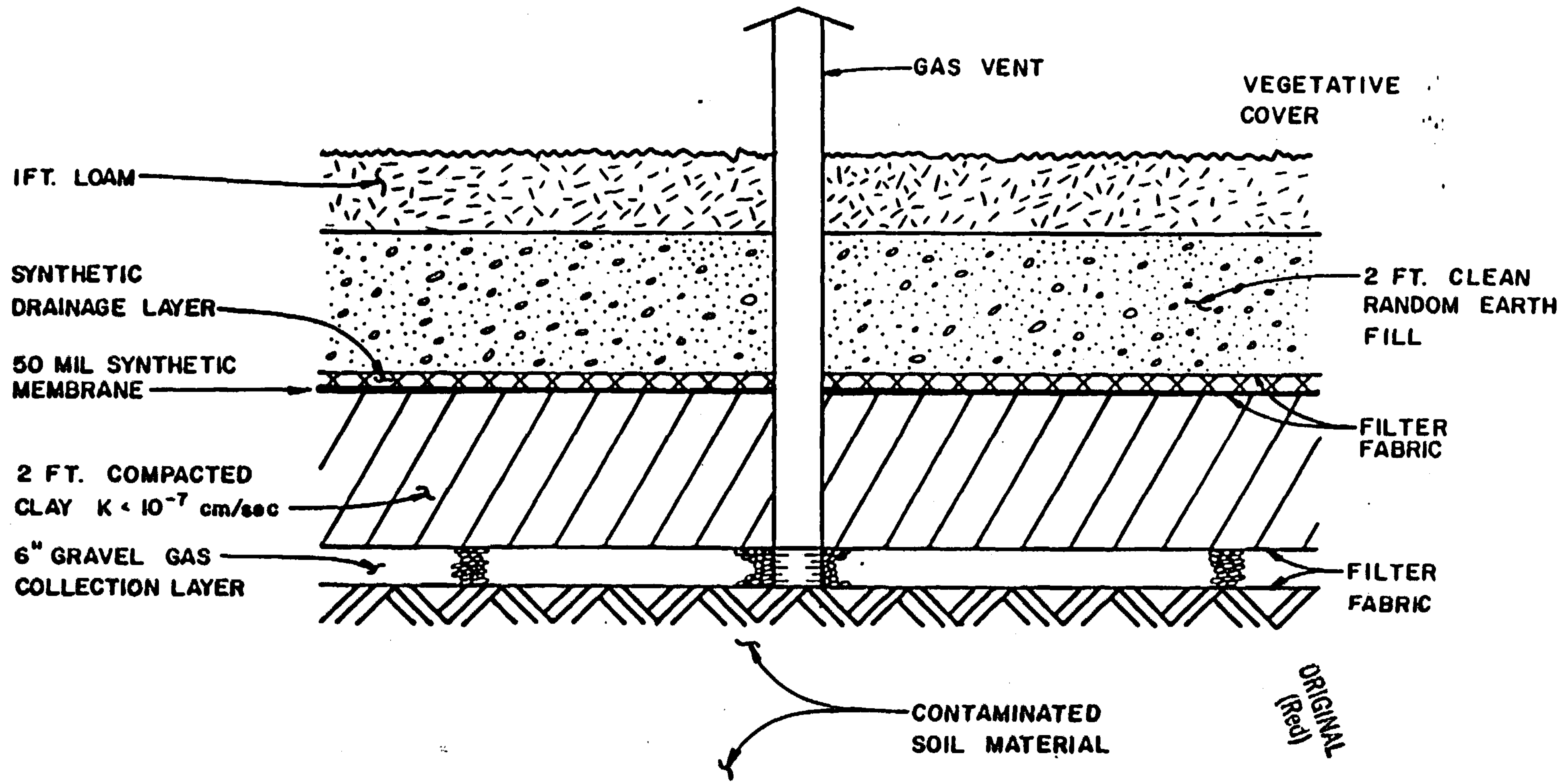
ORIGINAL (Red)

Concrete Cap: A concrete cap provides a nearly impermeable barrier over the contaminated solids. Cracking, however, would present a significant problem due to typical landfill subsidence, and would compromise the effectiveness of the cap. Construction , while not particularly complex, would be extremely expensive. The concrete cap technology will be eliminated from further consideration as other capping technologies can provide equivalent effectiveness at lower cost.

Multi-Layer Cap: A multi-layer cap would consist of a number of permeable and impermeable layers assembled to provide maximum containment, infiltration reduction and durability. Two multi-layer cap configurations would be applicable at this site: one satisfying the requirements of RCRA (CFR 40, Chapter 264) as interpreted in the RCRA Guidance Document, Surface Impoundments, Liner Systems, and Freeboard Control, July 1982, and one satisfying PA Solid Waste Regulations (PA Statutes, Title 25, 75.264(v)). The RCRA cap would include, from bottom up, a two foot thick compacted clay layer, a 50 mil flexible synthetic liner, a synthetic drainage layer, a two foot layer of clean earth fill, and a one foot layer of topsoil to support vegetation. The PA State cap would consist of, from the bottom up, a one foot compacted earth layer, a 50 mil flexible synthetic liner, a synthetic drainage layer and a two foot loam layer on top. Both systems would include a gas collection zone beneath the bottom cap to provide an outlet for landfill gas. The synthetic liner and drainage layer would be chosen to be compatible with the wastes and with each other. Figures 4-1 and 4-2 show representative sections of the RCRA cap and the PA State cap, respectively.

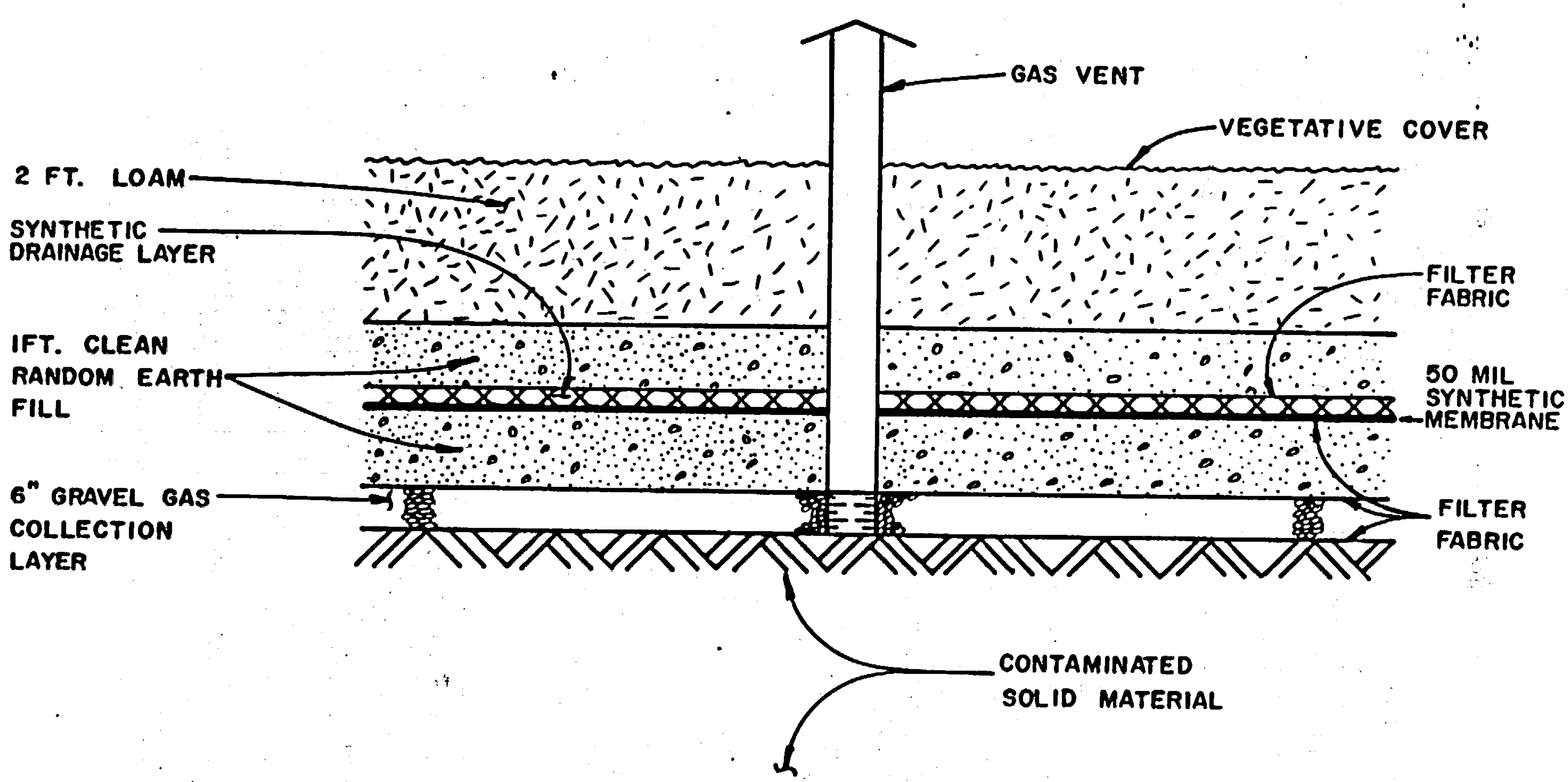
The multi-layer cap provides an extremely effective method of containment, as an impermeable flexible membrane is combined with protective layers to form a barrier highly resistant to failure. The effectiveness of the cap would not be compromised by typical landfill settlement due to the plastic properties of the clay or soil layers and the flexibility of the synthetic liner. In addition, the flexible membrane is protected from frost penetration (approximately 36 inches in this region) and other effects of weather by the vegetative layer. Continual inspection and maintenance would still be required to detect and repair minor erosion and any cracks which might form. Both the PA State and the RCRA multi-layer cap configurations will be retained for consideration in developing remedial alternatives.

Regrading: The high areas of the site would be excavated and used to backfill the existing ponds and low-lying areas, and a slope of about 2% would be imparted across the site to promote positive drainage. This action would reduce surface water retention and erosion, thus reducing the migration of solid media contaminants to surface water or sediment. In addition, regrading of the site would be necessary for proper implementation of other containment options such as capping. Regrading will be retained for consideration in developing remedial alternatives.



ORIGINAL (Red)

FIGURE 4 - 1
RCRA-TYPE MULTI-LAYER CAP
DORNEY ROAD FS



ORIGINAL (Red)

FIGURE 4-2
PA-TYPE MULTI-LAYER CAP
DORNEY ROAD FS

Runon/Runoff Controls: Surface water would be prevented from running onto the site by a perimeter dike, and all surface water accumulating on site would be diverted to a sedimentation pond prior to discharge from the site. The sedimentation pond would allow suspended solids to settle out of site runoff prior to discharge, thus reducing sediment load to the receiving stream and minimizing the migration of contaminated sediment. Such erosion control measures would be required with the implementation of a cap or landfill technology on site. The sedimentation pond would be designed to accommodate the water volume resulting from a 24-hour, 25-year storm, as stated in CFR Title 40, Chapter I, Part 264.310. Periodic dredging of the sedimentation pond would be necessary to maintain the required storage volume. Runon/runoff controls will be retained for consideration in developing remedial alternatives.

4.3.3 Removal

Excavation: Excavation is the only removal technology applicable to the contaminated solids media. Excavation of contaminated solids would eliminate the contaminant source, thus reducing exposure risks. Removal must be used in conjunction with either a disposal or treatment action to provide ultimate management of the contaminated material. Excavation could be implemented using standard procedures, however, the volume of material to be removed may necessitate staged excavation or other special handling requirements.

Excavation will be retained for consideration in developing disposal and treatment remedial alternatives.

Bulk Liquid Removal: Water would be pumped or siphoned from the onsite ponds, thus eliminating contaminated surface water from the site. In addition, surface water infiltration from the ponds causes groundwater mounding and the formation of leachate seeps along the south border of the site. Removal of the ponds should eliminate the leachate seeps as well. The ponds could be drained easily; however, the ponded water in the northwest portion of the site would require treatment prior to discharge. Bulk liquid removal will be retained for consideration in developing remedial alternatives.

4.3.4 Disposal

Disposal technologies provide complete, permanent containment of contaminated solids, thus fully eliminating the exposure pathway. A disposal action would also require the implementation of a removal action, since contaminated materials must be placed within a three-dimensional permanent storage unit. Onsite and offsite RCRA-compliant landfills are identified as applicable disposal technologies for contaminated solids, and deep well injection is identified for surface water. Discharge to surface water is also evaluated here as a means of permanently eliminating clean surface water.

Onsite RCRA Landfill: A RCRA-compliant landfill would consist of a double bottom liner system combined with a multi-layer cap. The bottom liner would include two flexible membrane liners, a compacted clay layer, a leachate collection system and a leak detection system. A schematic diagram of the bottom liner is presented as Figure 4-3. The cap, which would be continuous

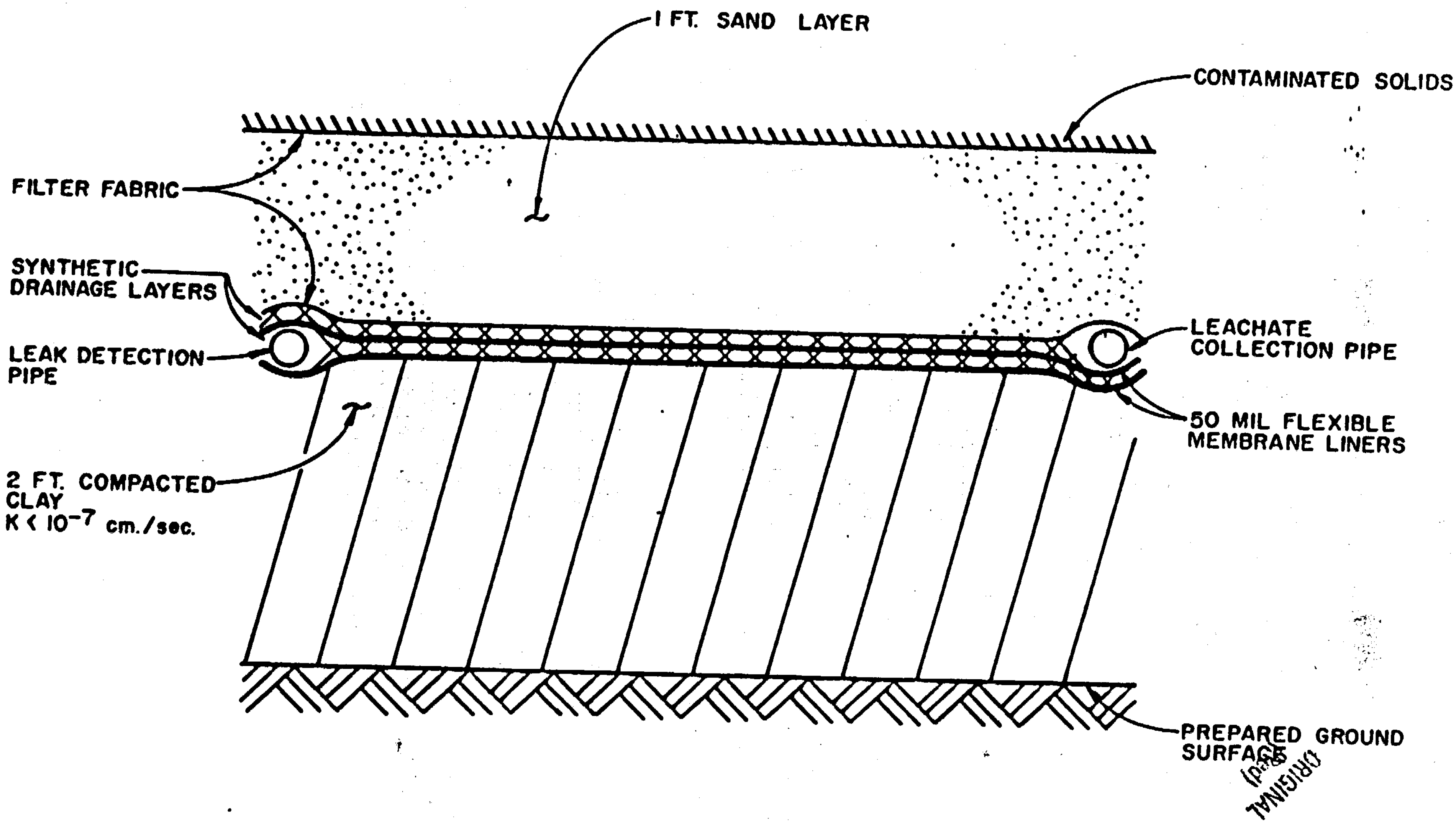


FIGURE 4-3
TYPICAL RCRA LANDFILL LINER
DORNEY ROAD FS

ORIGINAL
(Red)

with the bottom liner, would be of the same construction as a multi-layer cap described previously.

Construction of a RCRA landfill would be performed in several phases as the contaminated solids are excavated. This is necessary to minimize the amount of contaminated material exposed and because of limited area available for temporary storage (stock piling) of excavated solids. Because of the staged nature, construction would be complex, but not prohibitively so. The effectiveness of the RCRA landfill is dependent upon continued monitoring and maintenance for as long as the landfill is in place. Administrative approval may be difficult as landfilling of unaltered waste does not conform with the intent of SARA. Ultimate disposal of treatment residues by landfilling would, however, be acceptable under SARA. Onsite RCRA landfill will be retained for consideration during remedial alternative development.

Offsite RCRA Landfill: Similar to the previous technology, contaminated solids or solid treatment residues could be transported to a RCRA-permitted landfill facility for final disposal. This technology offers the same effectiveness as the onsite option but with additional short-term exposure risks during transportation. While onsite construction would not be required, all material would have to be excavated and placed in containers such as 55 gallon drums or lined roll-offs for transportation. Disposal of contaminated solids in an offsite landfill would be difficult to implement due to limited landfill volume available in the area. In addition, the cost of transportation and landfill use is considerably greater than that for construction of an onsite facility. Offsite landfilling will be eliminated from further consideration since it performs the same function as onsite landfilling, but with slightly lower effectiveness and significantly greater costs.

Deep Well Injection: Contaminated water is pumped into a well which extends into a deep formation naturally containing brackish water. The unit must be below and hydraulically isolated from any aquifers which could be used for drinking water supply. The disposal option does not conform with SARA nor is it feasible due to the lack of operating facilities in the area. Deep well injection will thus be eliminated from further consideration.

Discharge to Surface Water: Water meeting ARAR's and NPDES requirements could be discharged directly to the local surface water drainage. This would be applicable for water contained in the two ponds in the southwest portion of the site. While this option would be easy to perform, approval may be difficult to obtain. Discharge to surface water will be retained for consideration during assembly of alternatives.

ORIGINAL
(Red)

4.3.5 Treatment

Treatment technologies reduce the toxicity, mobility, or volume of contaminated solid materials, thus directly decreasing the contaminant source. Treatment actions are preferred under SARA as they provide permanent reduction of the contaminant source. While some treatments can be implemented with contaminated solids in place, most require excavation of the material to be processed.

Soil Vapor Extraction: Volatile compounds would be removed from the unsaturated soil matrix by applying a negative pressure (vacuum) to wells drilled into the vadose zone. The negative pressure would volatize compounds having vapor pressures greater than 20 mm Hg at 25°C, and these would be collected through the wells. Vapor extraction is most efficient for removal of compounds with vapor pressures greater than 100 mm Hg at 25°C, particularly water insoluble compounds.

Of sixteen volatile organic compounds detected in the onsite solid media, seven could be effectively removed and three could be removed with limited effectiveness using soil vapor extraction. Six volatile compounds, including chlorobenzene, would not be removed by this technology, nor would BNAs or pesticides. As such, soil vapor extraction provides limited effectiveness in reducing risks associated with the solid media. In addition, vapors extracted may require additional treatment prior to discharge to the atmosphere.

Construction would be relatively simple, relying on standard well installation techniques. The nature of the onsite materials may, however, preclude implementation. The municipal waste onsite is highly heterogeneous which would lead to preferential vapor pathways during extraction. Volatile compounds would not be removed uniformly from the vadose soil, potentially leaving areas of high contaminant concentration. Because of limited effectiveness combined with implementation difficulties, soil vapor extraction will be eliminated from further consideration.

Vitrification: Contaminated solids would be electrically heated in place until melted, then allowed to resolidify to form a vitreous mass. Organic compounds are incinerated by the high heat produced, while inorganics are permanently entrained in the resulting glass. Any off-gases are collected and treated so that contaminants are not released to the atmosphere. Under appropriate conditions and when properly implemented, the process is highly effective at destroying organic contaminants as well as immobilizing inorganic constituents.

Vitrification relies upon high silica content in the contaminated media (usually soil) in order to form a silica glass. In addition, no greater than 5% total organics can be present in the media for effective treatment. Municipal waste, the primary contaminated medium onsite, contains considerably greater than 5% total organics and a relatively small percentage of silica. For this reason, vitrification is not implementable at this site. Vitrification will be eliminated from further consideration.

ORIGINAL (Red)

Biological Treatment: Biological treatment consists of promoting the biodegradation of contaminants by creating favorable conditions for the microorganisms capable of metabolizing these compounds. The following parameters can be varied to optimize biodegradation potential: the size and type of the microbial population, pH, moisture content, oxygen content, temperature, and nutrient content. The most applicable biological treatment method for high organics content solids, such as municipal waste, is compositing, in which solids are excavated and placed in piles or rows where the above-mentioned parameters can be controlled relatively easily.

The effectiveness of the technology cannot be determined until bench scale and pilot scale tests are run to identify applicable microbial populations and associated treatment efficiencies. Several classes of compounds are present in the solid media including polynucleated aromatic hydrocarbons (PAHs), chlorinated volatile alphatics, monoaromatics, PCBs, and heavy metals. These contaminant classes require different microbial cultures for degradation, each with differing environmental needs. As such, treatment would have to be performed in discrete phases to address each of the various chemical classes present. Treatment of such a complex set of compounds is unproven and substantial research would be required to develop, acclimate, and maintain the necessary microbial populations. Given the complexity of this system, biological treatment will be eliminated from further consideration.

Water or Solvent Leaching: Organic or inorganic compounds are removed from solids by passing an extractant solution (water or other solvent) through the material. Extraction can be performed in situ, or in a reactor after excavation. Several different solvents would be required due to the variety of compounds present with a range of solubility properties. The effectiveness of this technology in removing contaminants is dependent on the adsorption coefficient of each of the compounds for the specific media: parameters that must be determined through laboratory testing of the materials in question. It is unlikely, due to the high organic content of the waste, that acceptable extraction efficiencies could be attained. Even if acceptable efficiencies could be attained a large volume of contaminated leachate would be generated, requiring further treatment.

Implementation of in situ leaching would be extremely difficult. Flushing and recovery of leaching solvents would be problematic due to the heterogeneity of the solid media and the absorbent properties of municipal waste. Excavation of the solid media with subsequent extraction in reactor vessels would be implementable, however, several different solvents would have to be employed in series to extract compounds of the various chemical classes present. Due to its limited effectiveness, water or solvent leaching will be eliminated from further consideration.

Supercritical Fluid Extraction: This technology is similar to water or solvent leaching, except that a fluid (usually liquified carbon dioxide) at its critical point is passed through the media to extract contaminants. Fluids at their critical point (temperature and pressure at which gaseous/liquid phase boundary disappears) act as extremely effective solvents. Compounds entrained in the critical fluid are driven out of solution when the fluid is returned to standard conditions. Due to the pressure and temperature requirements this process cannot be implemented in situ. Bench and pilot testing would be required to determine the removal efficiency attainable.

Implementation of this technology would be problematic due to the wide range of contaminants present on site, and the heterogeneous nature of the media, particularly since this technology is still in the developmental stage. Due to implementation difficulties, super critical fluid extraction will be eliminated from further consideration.

<u>Low Temperature Thermal Aeration</u>: This process is similar to soil vapor extraction, except that it is performed in a reactor vessel with heat supplied to volatilize contaminants instead of negative pressure. While thermal aeration would probably be capable of removing all volatile compounds detected, effectiveness in removing BNA, pesticide, and PCB contaminants would be limited. The discharge gas may require treatment prior to discharge, depending on VOC concentrations. Determination of the attainable effectiveness would require bench or pilot scale testing with the site media.

Implementation would not be particularly complex, however, all material to be treated must be excavated. Mobile units have been developed and used to treat soils contaminated with a small range of volatile compounds. Due to its limited effectiveness in treating non-volatile contaminants, thermal aeration will be eliminated from further consideration.

<u>Oxidation/Reduction</u>: Oxidizing or reducing agents are introduced into the contaminated media where they react with the contaminants to produce less-toxic compounds. Reduction generally applies to reducing the valence of metals such as lead, chromium, silver, and mercury. Oxidation is used to degrade organic compounds to smaller compounds, ultimately carbon dioxide and water if the reaction goes to completion.

The effectiveness of chemical treatments in multi-contaminant applications is limited due to the presence of competing side reactions which consume the reactant agent and can produce additional contaminants or explosive reactions. Implementation is also difficult due to the inherent problems in thoroughly contacting the contaminated solid media with the oxidizing or reducing agents. Oxidation/reduction will be eliminated from further consideration.

<u>Ultrasonic/Ultraviolet Treatment</u>: A slurry made of contaminated solid material is subjected to ultrasonic and ultraviolet energy within a reactor vessel. The ultrasonic energy acts to disaggregate the solids and freeing contaminants from the solid media while the ultraviolet radiation degrades the organic contaminants. This process has been shown to be effective for treating PCB-contaminated soil, but has not been demonstrated on multi-contaminant waste streams. This technology is still in the experimental stage of development. Implementation would require the waste to be excavated and mixed with water to form a slurry, thus increasing the volume of contaminated material. Due to its developmental status and unproven effectiveness in a multi-contaminant situation, ultrasonic/ultraviolet treatment will be eliminated from further consideration.

Solidification and Fixation: This group of technologies is designed to reduce the mobility of the contaminants within the medium. Solidification is accomplished by adding a solidifying agent which reacts chemically with contaminated solids to form a coherent solid mass. In the fixation process, chemicals are added which cause the contaminants to bind more tightly to the medium. The result of both processes is a reduction in contaminant leachability and a more easily handled waste form. Solidification and fixation have been proven effective in reducing the mobility of inorganic contaminants. Implementation, however, is precluded for municipal waste due to high organic content. As such, these technologies will be eliminated from further consideration.

Onsite Incineration: Contaminated solids are combusted in a mobile incinerator located onsite, resulting in complete destruction of organic constituents. Several processes are available including rotary kiln, fluidized bed, and infrared incineration. Auxilliary fuel is utilized as required in rotary kiln and fluidized bed incineration to promote combustion, while heat is supplied directly by electrical heating elements in infared incineration.

Incineration effectively destroys all organic material, thus reducing toxicity, mobility and volume. Inorganic contaminants, however, would not be significantly affected, and landfilling of the treatment product may be necessary.

Incineration effectiveness has been well demonstrated at permanent facilities, although the process has seen only limited onsite application. Construction would be relatively easy, as mobile and transportable units are commercially available. Permitting and public acceptance may be more difficult. Effluent gases and process water would require treatment. Onsite incineration will be retained for consideration during assembly of alternatives.

Offsite Incineration: The process is the same as described for onsite incineration except that the operation would be performed at a permitted commercial facility. The following facilities have been identified as potentially capable of treating contaminated soil and waste from the site:

- Chemical Waste Management
  SCA Incinerator
  Chicago, Illinois

- Chemical Waste
  TWI Incinerator
  Sauget, Illinois

ORIGINAL (Red)

- Stablex
  Columbia, South Carolina

- ENSCO
  Eldorado, Arkansas

- Rollins Environmental Services, Inc.
  Bridgeport, New Jersey

Offsite incineration offers all of the advantages of onsite incineration, but with several disadvantages. Large volumes of contaminated material would have to be placed in containers, such as 55 gallon drums or lined roll-offs, and transported to the treatment facility, thus increasing handling and short-term exposure risks. Also, since the treatment facility is responsible for the ultimate disposal of the treatment residue, treatment costs are higher and capacity is limited for materials exhibiting low volume reduction. Incineration facilities may not have the capacity to treat the volume of contaminated material present at the site. The overall cost of offsite incineration including transportation is substantially greater than that for onsite incineration. Due to these disadvantages, offsite incineration will be eliminated in favor of onsite incineration.

Offsite Water Treatment: Contaminated water could be transported to either a publicly owned treatment works (POTW) or a private RCRA-permitted facility for treatment. Either facility would be capable of effectively eliminating contaminants from the surface water. Receiving approval from a POTW for treatment of Superfund-derived waste would be extremely difficult due to liability, while private treatment approval would be relatively easy to obtain. POTW treatment will be eliminated, and treatment at a private RCRA-permitted facility will be retained.

Onsite Water Treatment: A mobile water treatment unit could be set up onsite to treat the contaminated water from the ponded area in the northwest portion of the site. Only volatile oragnic contaminants were detected in this water, therefore, the most applicable treatment systems would be either activated carbon adsorption or air strippers. Either of these systems would require mobilization to the site and preliminary testing to design the treatment process. Due to the small volume of contaminated water, less than 10,000 gallons, the cost of onsite treatment including mobilization would exceed that of private offsite facility treatment. On-site water treatment will therefore be eliminated from further consideration.

4.3.6 Monitoring

Monitoring technologies would be required in conjunction with any remedial action to detect potential contaminant migration from the solid media to other media. Monitoring does not provide direct protection of human health or environment, but can be used to indicate the failure of an implemented technology or the need for additional action. Periodic sampling and analysis would be performed on media leaving the site, specifically, surface water, sediment, and groundwater. Surface water and sediment (runoff) samples would be obtained at points where surface water flows from the site. Groundwater samples would be obtained from wells both upgradient and downgradient to indicate background contaminant concentrations as well as contamination leaving the site. Runoff and groundwater monitoring will be retained for consideration during assembly of alternatives.

4.3.7 Landfill Gas Discharge

The site is a municipal waste landfill which produces methane gas by natural biological action. Therefore, if a containment action is implemented, a system must be included for the collection and discharge of the landfill gas. A gas collection layer was discussed in a previous section with the multi-layer cap. Two options are available for the discharge of collected gas to the atmosphere; passive vents and active vents.

Passive vents allow the free passage of gas out of the collection layer through well-like vents. Active vents utilize the same venting structure, but with the addition of a fan or other device to draw a suction through the vent. Active vents are implemented in situations where gas does not vent freely by itself or where it is vital that no gas migrates and escapes beyond the containment layer. The observed conditions at the site indicate that collected landfill gas would vent freely. In addition, natural venting of the landfill gas beyond the limits of the containment layer would not pose a problem as there are no residences or other structures in close proximity. Therefore, passive vents will be retained for consideration during assembly of alternatives and active vents will be eliminated.

4.4 SUMMARY

Thirty-two potentially applicable technologies have been screened to determine their feasibility for use at the Dorney Road Landfill Site. Fifteen of these technologies have been retained for incorporation into the comprehensive remedial alternatives. Table 4-3 lists the remedial technologies retained for assembly of alternatives.

ORIGINAL (Red)

TABLE 4-3
TECHNOLOGIES RETAINED FOR ASSEMBLY OF ALTERNATIVES
DORNEY ROAD FEASIBILITY STUDY

RESPONSE ACTION	TECHNOLOGY
Minimal/No Action	None Site Fencing Deed Restrictions
Containment	Soil Cover Multi-Layer Cap Regrading Runon/Runoff Controls
Removal	Excavation Bulk Liquid Removal
Disposal	Onsite RCRA Landfill Discharge to Surface Water
Treatment	Onsite Incineration Private RCRA Facility Water Treatment

ANCILLARY ACTION	TECHNOLOGY
Monitoring	Runoff Monitoring Groundwater Monitoring
Landfill Gas Discharge	Passive Vents

5.0 DEVELOPMENT OF REMEDIAL ALTERNATIVES

ORIGINAL (Red)

In this section, suitable remedial technologies identified in Section 4.0 are assembled into remedial action alternatives intended to meet the remedial response objectives. CERCLA amendments, Section 121(b), indicate the following statutory preferences when developing and evaluating remedial alternatives:

- o Remedial actions that involve treatments that permanently and significantly reduce the volume, toxicity, or mobility of the contaminants or hazardous substances are preferred over remedial actions not involving such treatment.

- o Offsite transport and diposal of hazardous substances or contaminated materials without treatment is considered the least-favored alternative remedial action when practical treatment technologies are available.

- o Remedial actions using permanent solutions, alternative treatment technologies, or resource recovery technologies shall be assessed.

Based on these statutory preferences, emphasis has been placed on developing alternatives which, as a principal element, permanently and significantly reduce the mobility, toxicity, or volume of the waste. Furthermore, alternatives should be developed to attain the response objectives developed, as stated in Section 3.0, as follows:

- o The remedial alternative is protective of human health and the environment.

- o The remedial alternative can attain chemical-specific ARARs and can be implemented in a fashion consistent with location- and action-specific ARARs.

- o The remedial alternative uses permanent solutions and alternate treatment technologies to the maximum extent practicable.

- o The alternatives developed are capable of achieving a remedy in a cost-effective manner.

The remedial alternatives must conform to requirements set forth in CERCLA, as amended, and to the best extent practicable, the NCP.

The alternatives developed as part of this FS are source control actions. These actions address hazardous substances still onsite at or near the locations where they were originally disposed. The purpose of these types of actions are to reduce direct contact and prevent future migration by surface water runoff. Migration by groundwater will be addressed in a supplemental FS. These remedies seek to remove, stabilize, and/or contain the hazardous substances.

The EPA OWSER Directive No. 9355.0-19, dated December 24, 1986, provides guidance regarding implementation of CERCLA amendments and effects of the new statute on the remedy selection process. The OSWER directive states that "treatment alternatives should be developed ranging from an alternative that, to the degree possible, would eliminate the need for long-term management (including monitoring) at the site to alternatives involving treatment that would reduce toxicity, mobility, or volume as their principal element". Thus, alternatives may involve different technologies for different types of wastes, but vary principally in the degree to which they rely on long-term management of treatment residuals or low-concentration wastes. The OSWER directive also indicates that a containment option (involving little or no treatment) and a no-action alternative should be developed.

5.1 APPROACH OF TECHNOLOGIES TO RESPONSE ACTIONS

Remedial action alternatives were developed using the technologies that passed the screening process in Section 4.0 (see Table 4-3). The technologies maintained for further consideration were evaluated for their ability to successfully attain ARARs applicable to existing site conditions (see Section 2.0), and to achieve response objectives developed in Section 3.0. Based on site conditions, remedial response objectives were initially developed to mitigate existing and future threats to public health and the environment. The response objectives identified to mitigate threats to public health are as follows:

1. Prevent direct contact (incidental ingestion and dermal absorption) with contaminated soils (and solid wastes) throughout the site by trespassers, hunters, residents and construction workers;

2. Prevent direct contact (incidental ingestion and dermal absorption) with contaminated surface water located in the northwest portion of the site; and

3. Implement no actions that could interfere with future groundwater remediation.

5.2 POTENTIAL TREATMENT ALTERNATIVE AREAS AND VOLUMES

An attempt was made to identify a range of treatment alternatives to satisfy the requirements of the OSWER directive on alternative development. Since primarily solid materials associated with the landfill (soils and solid waste) are being addressed by this FS, attempts were made to divide areas of the landfill by contamination and public health hazards, and to selectively remediate various sections. By varying the amounts of area (and assoicated contamination and risk) being treated, a range of alternatives would be generated.

Samples of the onsite solid media (surface soils, subsurface waste soils, and subsurface natural soils) analyzed during the RI show a relatively random distribution of contaminants in three dimensions, with no clear indication of a "hot spot" region. Figures 5-1, 5-2 and 5-3 show the locations of high

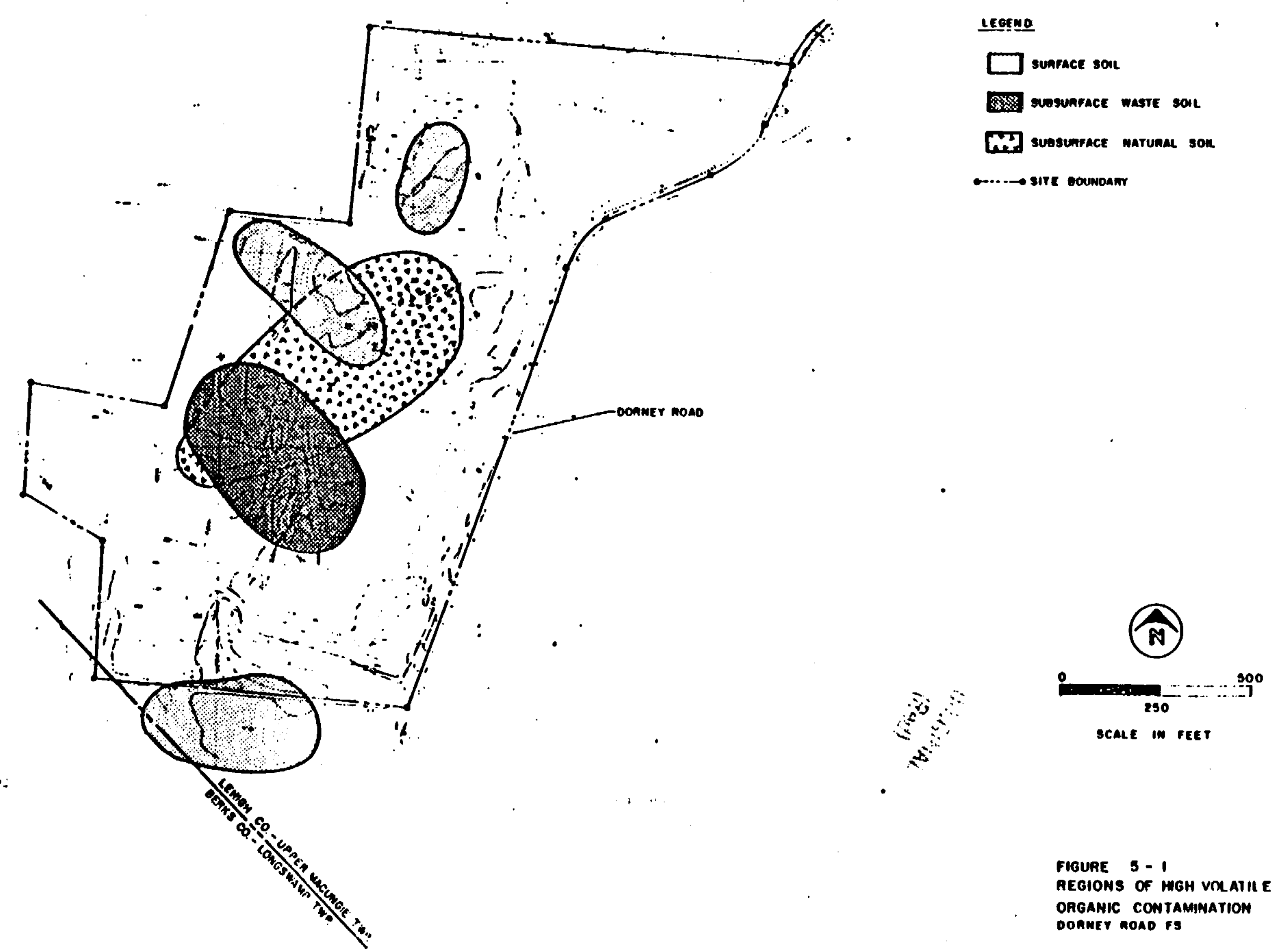


FIGURE 5 - 1
REGIONS OF HIGH VOLATILE ORGANIC CONTAMINATION
DORNEY ROAD FS

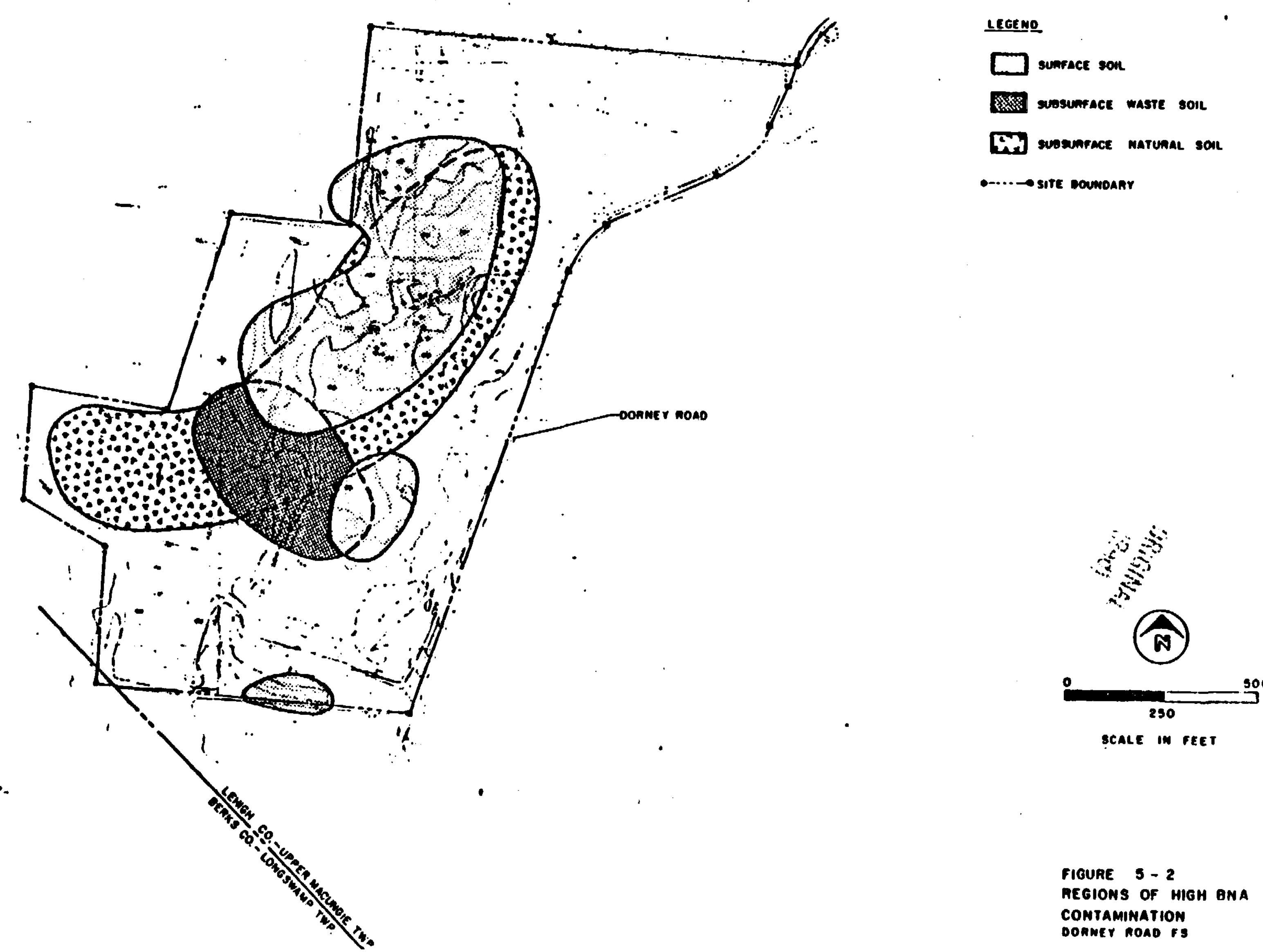


FIGURE 5 - 2
REGIONS OF HIGH BNA
CONTAMINATION
DORNEY ROAD FS

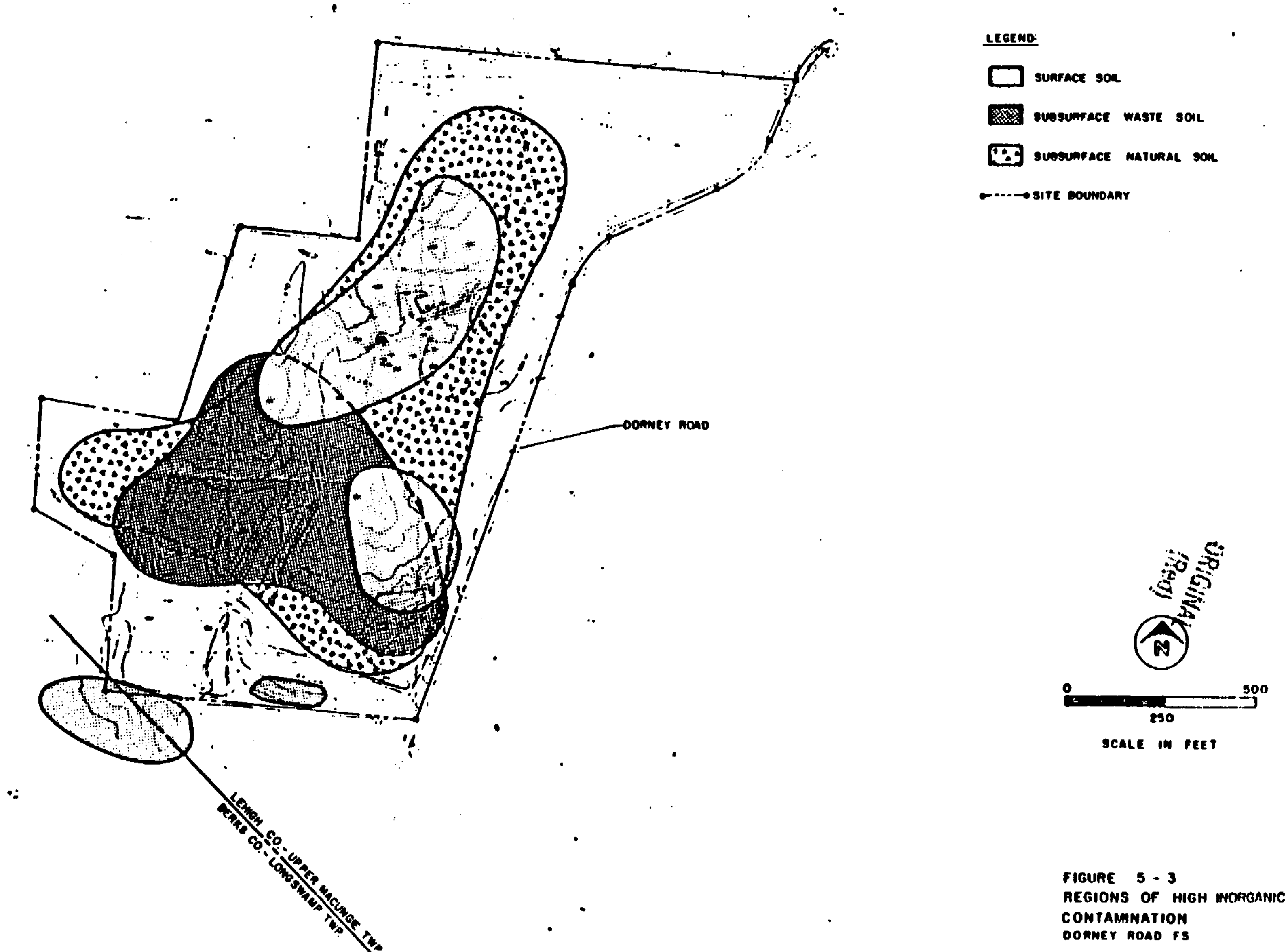


FIGURE 5 - 3
REGIONS OF HIGH INORGANIC CONTAMINATION
DORNEY ROAD FS

concentrations of volatile organic, BNA and inorganic contaminants detected in the three media sampled. No spatial trends are apparent with respect to either contaminant type or medium; therefore, regions of relatively high contaminant concentration cannot be defined. The entire landfill area must be defined as the primary contaminant source for consideration in development of source control remedial alternatives. Figure 5-4 shows the area of the landfill and depth to the bottom of the waste pit based on RI borings. The northeast portion of the site is not included in site cleanup since dieldrin was the only contaminant detected and was attributed to agricultural land use rather than the site.

In conclusion, discrete regions of contaminated solid media related to specific health risk levels cannot be delineated for the Dorney Road Landfill site. As a result, a range of treatment alternatives was not developed based on remediation of contamination "hot spots".

5.3 ASSEMBLY OF REMEDIAL ALTERNATIVES

Based on the remedial response objectives, five remedial alternatives are developed which provide varying degrees of human health and environmental protection. These alternatives incorporate the remedial technologies retained through the screening process of Section 4. Figure 5-5 presents an array of the five remedial alternatives and their component technologies. A detailed discussion of each alternative is provided below.

5.3.1 <u>Alternative No. 1: Minimal/No Action</u>

The National Contingency Plan (NCP) requires that a "no action" alternative be evaluated through the detailed analysis to provide a baseline for comparison to other alternatives. This alternative provides minimal to no protection of human health and no protection of the environment. The resultant risks associated with the Minimal/No Action alternative would be the same as those identified in the Public Health Evaluation included in the RI and the risk assessment summarized in Section 2 of this report.

Several minimal actions would be required, even with the "no action" alternative. These are:

- Perimeter Fence
- Deed Restrictions
- Runoff Monitoring
- Groundwater Monitoring

A plan view of the site showing the proposed fence and monitoring locations is presented on Figure 5-6. Implementation of the remedial technologies is discussed below.

<u>Perimeter Fence</u>: A chain link fence would be constructed around the site perimeter to reduce pedestrian and animal traffic across the site. No fence

ALTERNATIVE	COMPONENT TECHNOLOGIES										
	PERIMETER FENCE	DEED RESTRICTIONS	SURFACE WATER ELIMINATION	REGRADING	SOIL COVER	MULTI-LAYER CAP	ONSITE LANDFILL	GAS DISCHARGE SYSTEM	INCINERATION	RUNOFF MONITORING	GROUNDWATER MONITORING
MINIMAL/NO ACTION	X	X								X	X
SOIL COVER	X	X	X	X	X					X	X
MULTI-LAYER CAP	X	X	X	X		X		X		X	X
ONSITE RCRA LANDFILL	X	X	X	X		X	X	X		X	X
ONSITE INCINERATION	X	X	X	X		X	X		X	X	X

ORIGINAL (Red)

FIGURE 5-5
ALTERNATIVE ARRAY
DORNEY ROAD FS

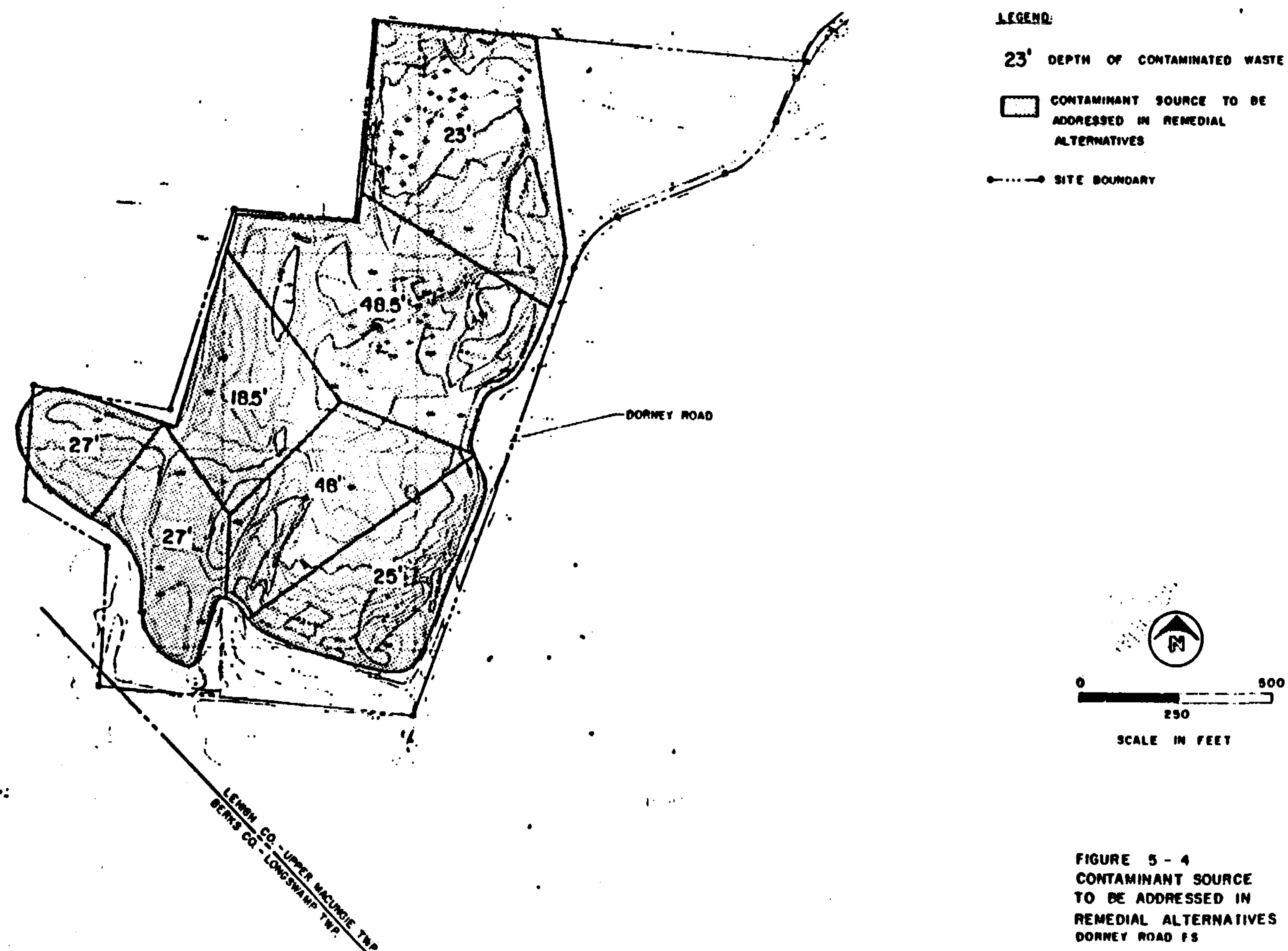


FIGURE 5 - 4
CONTAMINANT SOURCE
TO BE ADDRESSED IN
REMEDIAL ALTERNATIVES
DORNEY ROAD FS

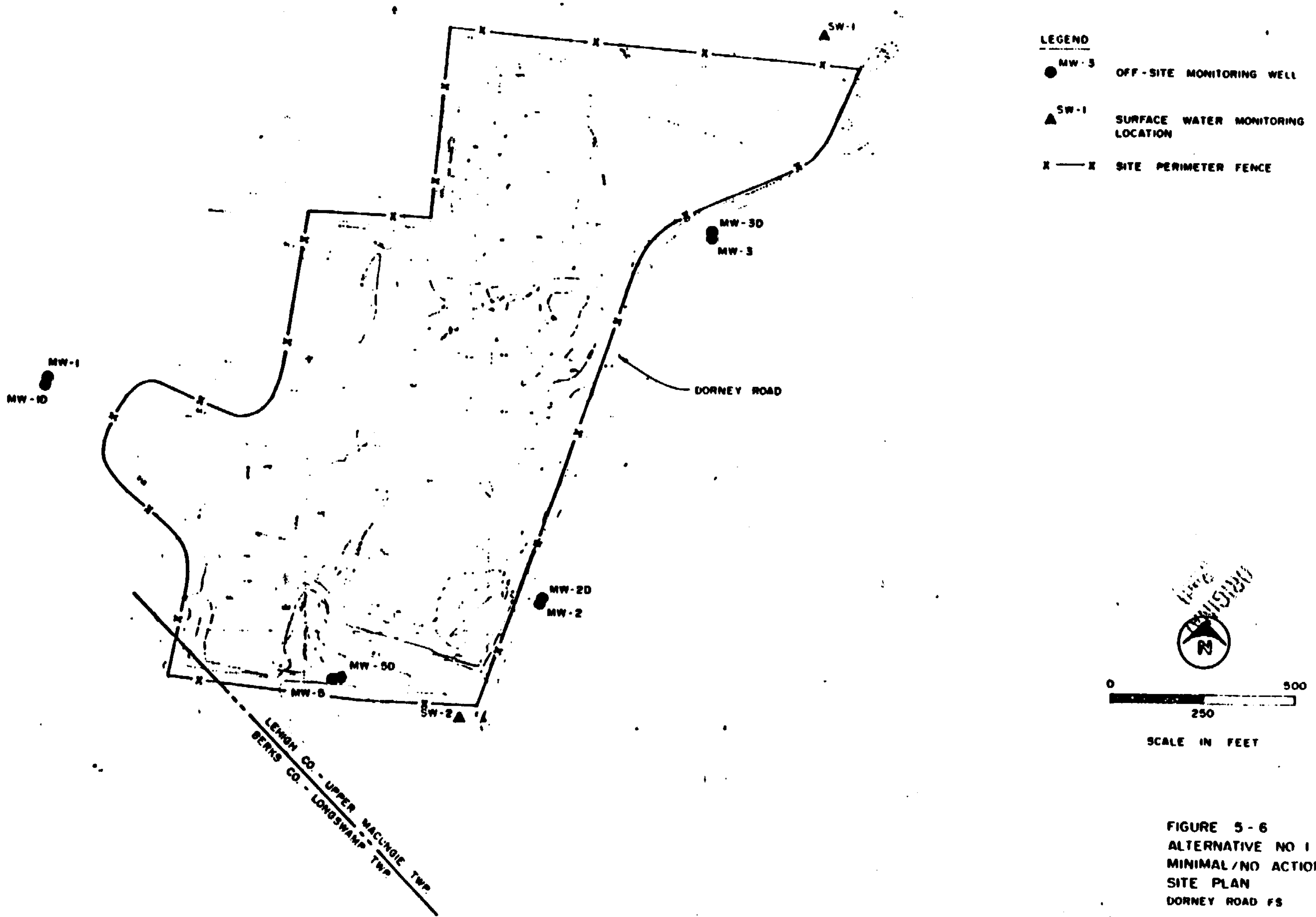


FIGURE 5-6
ALTERNATIVE NO 1
MINIMAL/NO ACTION
SITE PLAN
DORNEY ROAD FS

ORIGINAL (Red)

currently exists at the site. Approximately 6,600 linear feet of fence would be erected to enclose the entire area of concern. Semi-annual inspections would be required to detect breaches in the fence and maintenance would be ongoing for as long as contaminants remain on site.

Deed Restrictions: Legal restrictions would be placed on the use of land within the site boundaries. A clause prohibiting future development or excavation of the contaminated areas would be added to the property deed or deeds, which include the site.

Runoff Monitoring: Surface water currently drains from the site at two locations: the northeast corner and the southeast corner, both along Dorney Road. Samples of both sediment and surface water would be collected from these locations and analyzed for TCL compounds on a semi-annual basis. Runoff monitoring would be used to detect migration of contaminants from solid waste to surface water and sediment and ultimately off site. Increases in contaminant levels in surface water or sediment leaving the site could indicate the need for further remedial action to adequately protect human health and the environment. Monitoring would be required for as long as contaminants remain on site.

Groundwater Monitoring: Groundwater would be monitored both upgradient and downgradient of the site to detect changes in groundwater quality due to leaching of landfill contaminants. Groundwater flow beneath the site is generally from northwest to southeast. Existing well nests MW-2, MW-3, and MW-5 are located downgradient of the site and well nest MW-1 is located upgradient (see Figure 5-6). Each nest consists of a shallow and a deep well and would be adequate for monitoring purposes. Samples would be obtained from both the shallow and deep wells at each of the four well nests on a semi-annual basis. Full TCL analyses would be performed, with results recorded on a permanent record. Increases in contaminant concentrations may indicate the need for additional remedial action to adequately protect human health and the environment.

5.3.2 Alternative No. 2: Soil Cover

Alternative No. 2 is intended to provide protection of human health by eliminating the exposure pathway for solid media contaminants, but provide minimal protection of the environment. The soil cover would act as a physical barrier over the contaminated solid media, thus reducing potential contact and incidental ingestion of contaminants. Migration of contaminants from the solid media to groundwater would not be significantly reduced, as infiltration would remain relatively unaffected. Alternative No. 2 includes the following major components:

- Perimeter Fence
- Deed Restrictions
- Surface Water Elimination
- Regrading
- Runon/Runoff Controls
- Soil Cover

ORIGINAL
(Red)

- o Runoff Monitoring
- o Groundwater Monitoring

A plan and a cross section of the site showing implementation of the above technologies are presented on Figures 5-7 and 5-8, respectively. Following is a detailed discussion of how each component of this alternative will be implemented. The previous discussions of the perimeter fence, deed restrictions, and groundwater monitoring are applicable here and will not be repeated.

<u>Surface Water Elimination</u>: The two existing onsite ponds and a surface water feature in the northwest portion of the site must be eliminated to allow proper construction of the soil cover. In addition, the remedial investigation indicated that the leachate seeps in the south of the site are largely a result of groundwater mounding caused by the infiltration of surface water from the ponds. Therefore, removal of the onsite ponds would eliminate groundwater mounding, and greatly reduce or eliminate the leachate seeps.

A total of approximately 700,000 gallons of water are contained in two ponds located in the southwest portion of the site and two smaller ponds located in the north-central portion of the site. On the basis of the Public Health Evaluation, contamination in the ponded water poses no health risks greater than acceptable limits. Therefore, the ponds can be drained and discharged to existing surface water drainage systems off site. A centrifugal pump would be used to pump the water from the ponds to the natural drainage at the northeast corner of the site. Although pond sediment does not pose a health risk, a filter would be employed to reduce the suspended solids load of water entering the receiving drainage. Filtered solids would be returned to the pond areas at the completion of pumping. Based on the capacity of existing surface drainage features, it is estimated that the ponds could be pumped dry in a period of 24 hours.

The surface water collection feature located in the northwest portion of the site (less than 5,000 gallons) was contaminated and generated a cancer risk greater than 10^{-6} during the performance of the PHE. The water in this feature will be pumped out and transported offsite for treatment at a permitted RCRA facility.

<u>Regrading</u>: Regrading is required to provide positive drainage across the site, preventing the retention of surface water. The surface of the landfill would be graded to generally slope toward the north. The landfilled "tongue" projecting toward the west would be graded to drain to the south and west. A perimeter ditch would be constructed, designed, and graded to intercept all runoff from the landfill and to conduct the water to the southeastern corner of the site where offsite discharge would be to the east. A culvert beneath Dorney Road would be required.

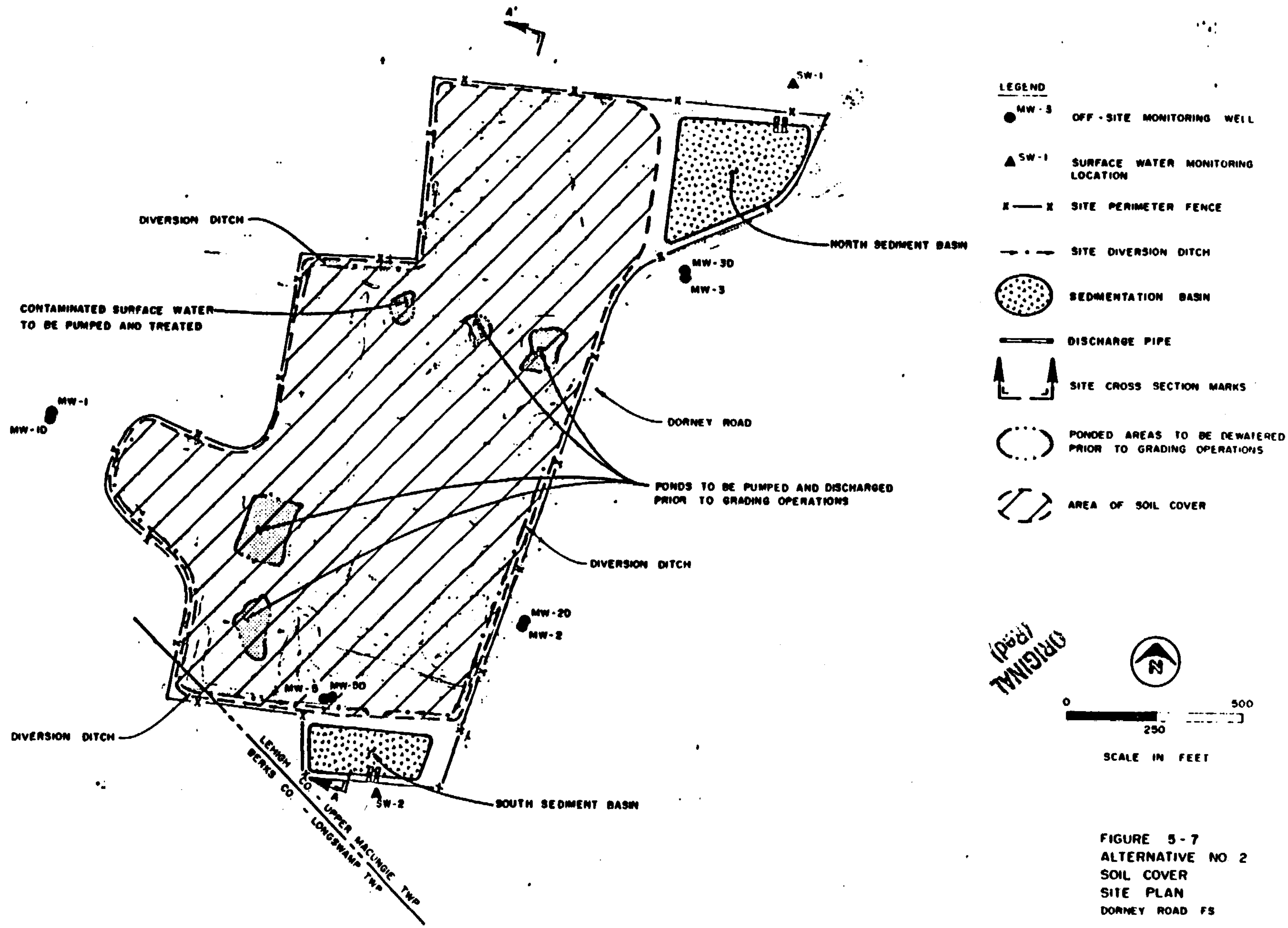


FIGURE 5-7
ALTERNATIVE NO 2
SOIL COVER
SITE PLAN
DORNEY ROAD FS

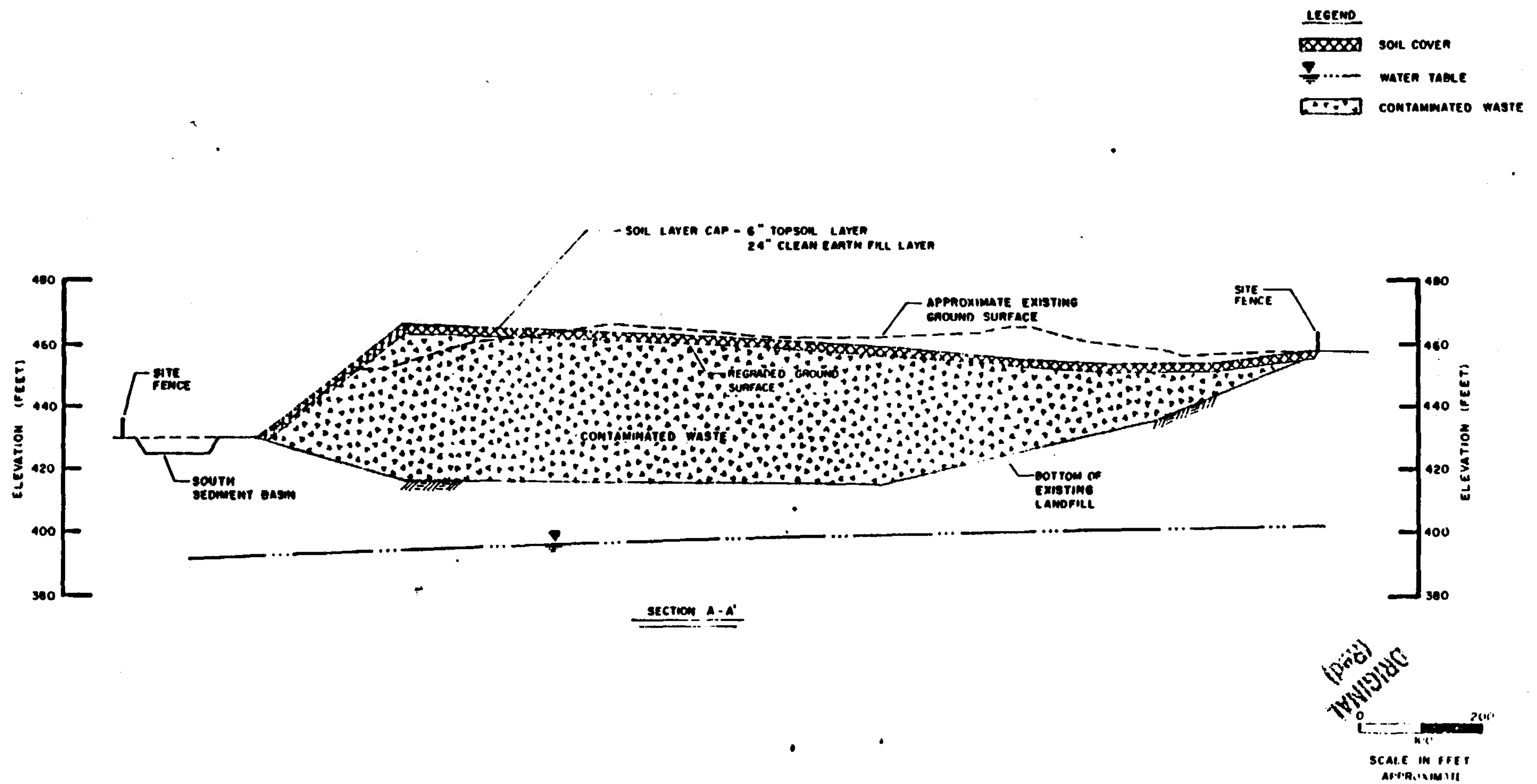


FIGURE 5-6
ALTERNATIVE NO. 2
SOIL COVER
GENERALIZED SECTION A-A'
DORNEY ROAD FS

Approximately 110,000 cu. yds. of soil would be cut from high areas on site and used to fill low areas. This would include filling the drained ponds. Regrading of the site could be completed in approximately three months.

Runon/Runoff Controls: A dike and diversion ditch system would be constructed around the site to eliminate site runon and to divert runoff to two sedimentation ponds. A 6.5 million gallon pond would be constructed at the northeast corner of the site to receive the majority of site runoff. A 2 million gallon pond would be constructed at the south of the site to receive drainage primarily from the outslopes around the southern half of the site. Locations of these ponds are shown on Figure 5-7. These ponds would be of sufficient size to contain all onsite runoff from a 24-hour, 25-year storm while still allowing two feet of freeboard. Relatively sediment-free runoff would be discharged from the ponds via perforated riser pipes. Periodic dredging of the sediment ponds would be necessary to maintain the storage capacity.

Soil Cover: After the site is regraded, a uniform layer of clean soil would be placed over the surface to prevent contact with contaminated solid media. The soil cover would consist of a 2-ft. thick layer of clean, random earth fill overlain by a 6-in. layer of topsoil. The clean fill layer would be compacted, while the topsoil would be left uncompacted to allow for plant growth. The soil cover would be vegetated with resilient, perennial plants to reduce erosion.

Approximately 110,000 cu. yds. of clean, random fill and 28,000 cu. yds. of topsoil would have to be purchased to cover the 35 acres of contaminated area on site. Construction would require approximately three to six months, and could be performed as regrading work proceeded to minimize total construction time. Complete implementation of this alternative, including pond elimination, site grading, and soil cover construction, could be accomplished in approximately six months to one year. In addition to initial construction, periodic maintenance would be required. Periodic maintenance would include annual inspections, repair of any erosion features, replacement of any eroded topsoil and reseeding and care of vegetation.

Runoff Monitoring: Since all surface water would be redirected to the sediment basins in the north and south prior to leaving the site, monitoring would be required at the basin discharge points. The procedure and frequency of sampling would be the same as described for Alternative No. 1.

5.3.3 Alternative No. 3A: RCRA-Type Multi-Layer Cap

Implementation of Alternative No. 3A is intended to provide protection of both human health and the environment. The multi-layer cap would act as an effective barrier virtually eliminating hazards of direct contact and incidental ingestion of contaminants. In addition, the impermeable cap would minimize infiltration, thus reducing migration of contaminants from the solid media to groundwater. The major components of this alternative are as follows:

- o Perimeter Fence
- o Deed Restrictions
- o Surface Water Elimination
- o Regrading
- o Runon/Runoff Controls
- o RCRA-Type Multi-Layer Cap
- o Runoff Monitoring
- o Groundwater Monitoring

ORIGINAL (Red)

A plan view and cross section of the site showing implementation of the proposed alternative are presented on Figures 5-9 and 5-10, respectively. All technologies, except the multi-layer cap, would be implemented as discussed previously.

RCRA Multi-Layer Cap: A multi-layer cap compliant with RCRA guidelines (RCRA Guidance Document, Surface Impoundments, Liner Systems and Freeboard Control, July 1982) would be constructed to cover all contaminated solid media on site.

Several construction options are available, each with associated advantages and disadvantages. The RCRA compliant cap could be constructed over the entire site, including the western "tongue" and the extension to the north, or contaminated material from one or both of these "extensions" could be excavated and used to grade the rectangular central portion of the site. The excavations would be backfilled with clean earth fill and the cap would be constructed over the central portion of the site only. Consolidation of material into the center of the site would reduce the area of the multi-layer cap and render the excavated areas uncontaminated. A detailed analysis was performed comparing capping the entire site with excavating the western tongue, then capping only the central and northern portions of the site.

The western tongue comprises approximately 2.25 acres and an estimated 100,000 cu. yds. of contaminated landfill waste and soil. Excavating this material and using it to regrade the other portions of the site would reduce the area to be capped by 2.25 acres and, consequently, the cap construction cost is estimated to be about $570,000 less. The volume of material to be excavated is roughly the same as that required to regrade the site; therefore, excavation and regrading costs would be approximately equal for either option. The cost to backfill the excavation with clean material would be associated only with the excavation option and would add about $1,200,000 to the cost. The net result would be an estimated cost increase of $630,000 to reclaim 2.25 acres. In addition, excavation of waste material from the tongue would result in increased exposure risks during construction.

Potential benefits of moving the waste from the tongue area to the central portion of the site prior to capping are outweighed by the increased cost and added risks. Similarly excavation and consolidation of waste from the north extension of the site can be eliminated, since a larger area and waste volume

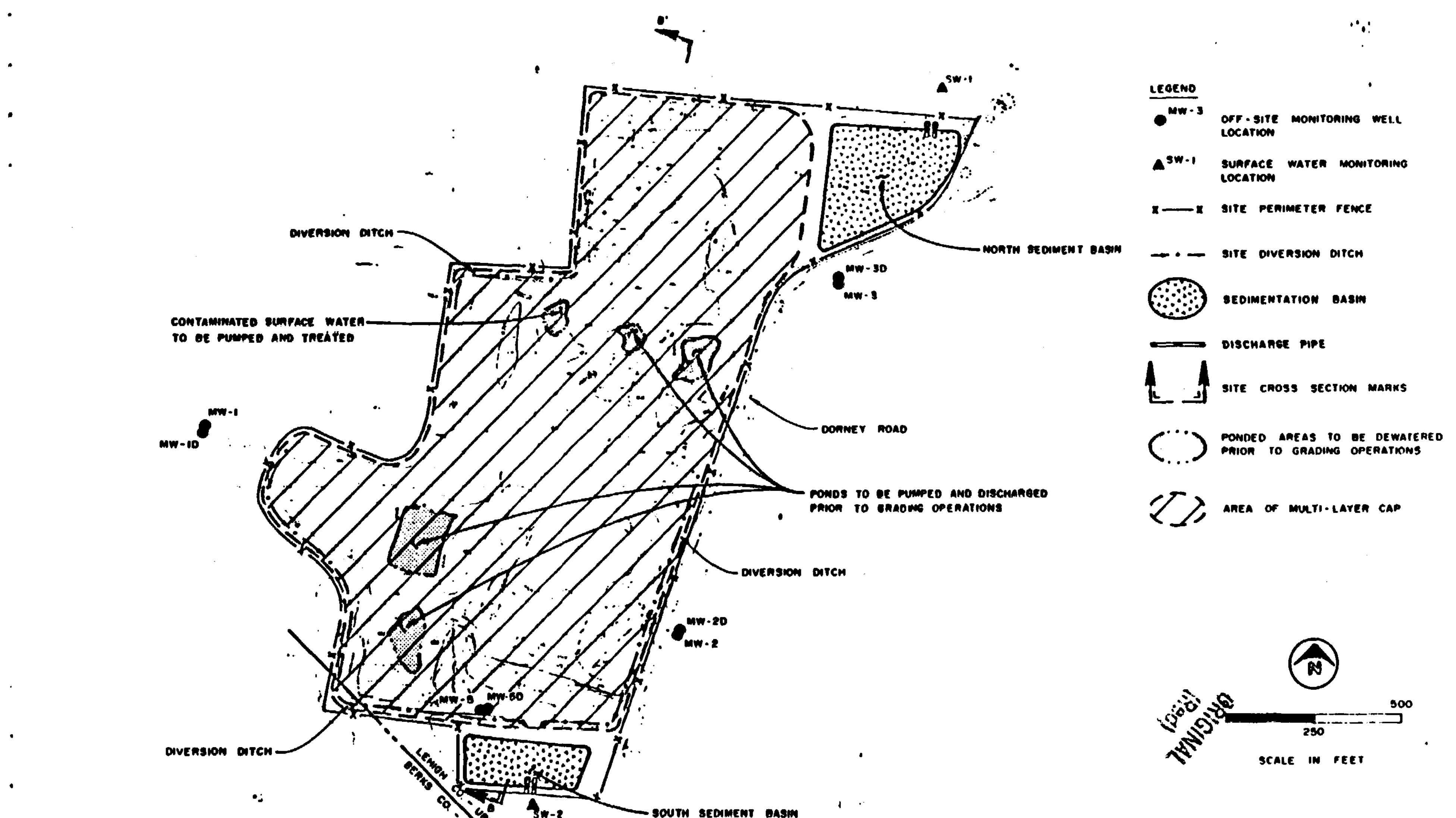


FIGURE 5-9
ALTERNATIVE NO 3A / 3B
MULTI-LAYER CAP
SITE PLAN
DORNEY ROAD FS

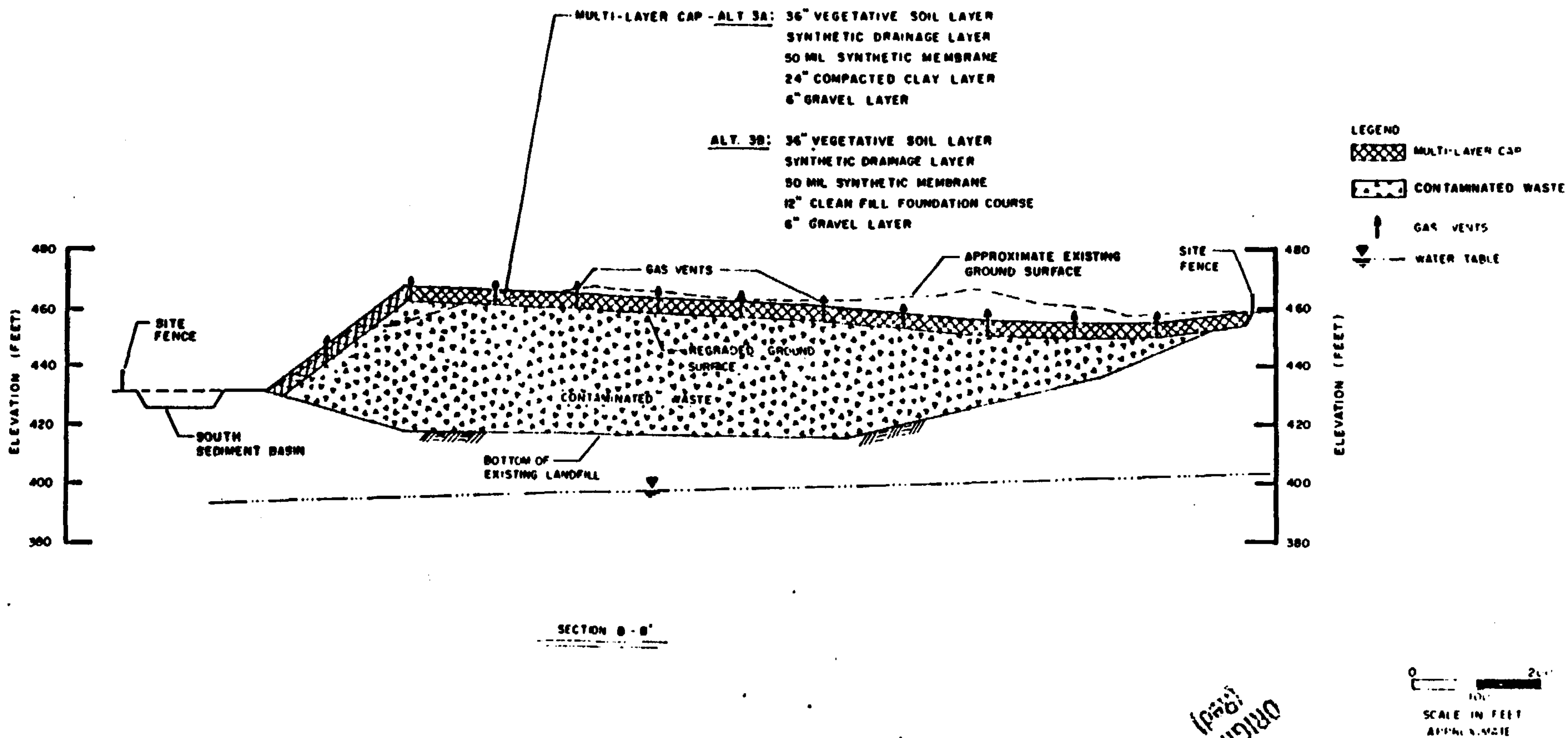


FIGURE 5-10
ALTERNATIVE NO. 3A/3B
MULTI-LAYER CAP
GENERALIZED SECTION B-B'
DORNEY ROAD FS

ORIGINAL (Red)

are involved. Therefore, the most advantageous option would be to cap the entire site, without moving waste.

The RCRA-compliant cap would be constructed over an area of approximately 35 acres, and would consist of the following: 2-ft. compacted clay layer, 50 mil flexible synthetic liner, synthetic drainage layer, 2-ft. vegetative zone, and gas collection system. In addition, 1 ft. of compacted earth would be placed over the regraded site surface to provide a solid foundation for the cap. The vegetative zone would consist of a layer of topsoil underlain by a layer of compacted earth to prevent root penetration through the impermeable liner. Gas collection would be accomplished by a system of 54 well-type vents screened through a high permeability gravel bed located beneath the impervious layers. The synthetic liner and drainage layer would be chosen to be compatible with the waste materials and with each other. Seams in the synthetic liner would be thermally welded to produce a continuous sheet and gas vents would be sealed to the liner by means of specialized collars to maintain liner integrity. A representative section through the RCRA cap is presented on Figure 5-11.

Construction of the cap, including regrading of the site, could be completed in about one year. As with the soil cover, periodic maintenance would be required, including seasonal care of cap vegetation and quarterly inspections.

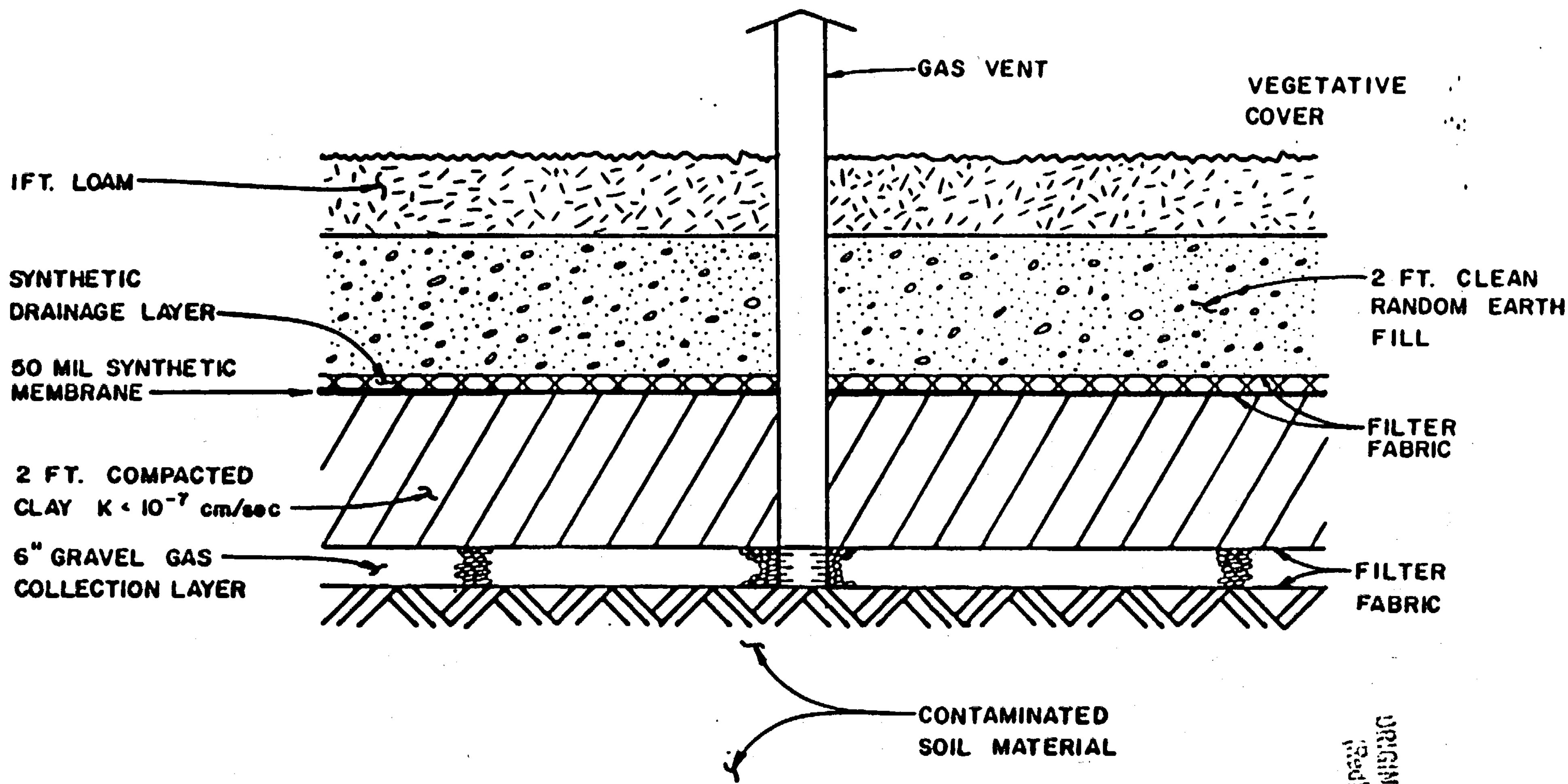
It is also assumed that the vegetative layer would require replacement every 10 years.

5.3.4 Alternative No. 3B: PA-Type Multi-Layer Cap

Alternative 3-B has the same major component and is identical to Alternative 3A except that construction of the multi-layer cap would conform to PA Solid Waste Regulations (PA Statutes, Title 25, 75.264(v)) rather than RCRA guidance. The degree of protectiveness is equal with either cap configuration; however, the cap compliant with PA regulations would be significantly less costly. The area covered would be the same as that defined for Alternative 3A. Figures 5-9 and 5-10 are applicable to this alternative, as well as Alternative 3A, and show a plan view and cross section of the site with implementation of the cap.

The PADER-compliant cap would consist of a one foot thick compacted earth base course, a 50 mil flexible synthetic liner, a synthetic drainage layer, and a two foot thick vegetated loam layer. A gas collection system consisting of a 6 inch thick gravel layer and well type vents would also be included beneath the compacted earth base course. Construction considerations would be the same as described for the RCRA-type cap. A representative section through the cap is presented on Figure 5-12.

As with the RCRA-type cap, construction (including regrading) could be completed in about one year. Seasonal maintenance of the vegetation and quarterly inspections would be required, as well as replacement of half of the loam layer and revegetation every ten years.



ORIGINAL (Red)

FIGURE 5-11
RCRA-TYPE MULTI-LAYER CAP
DORNEY ROAD FS

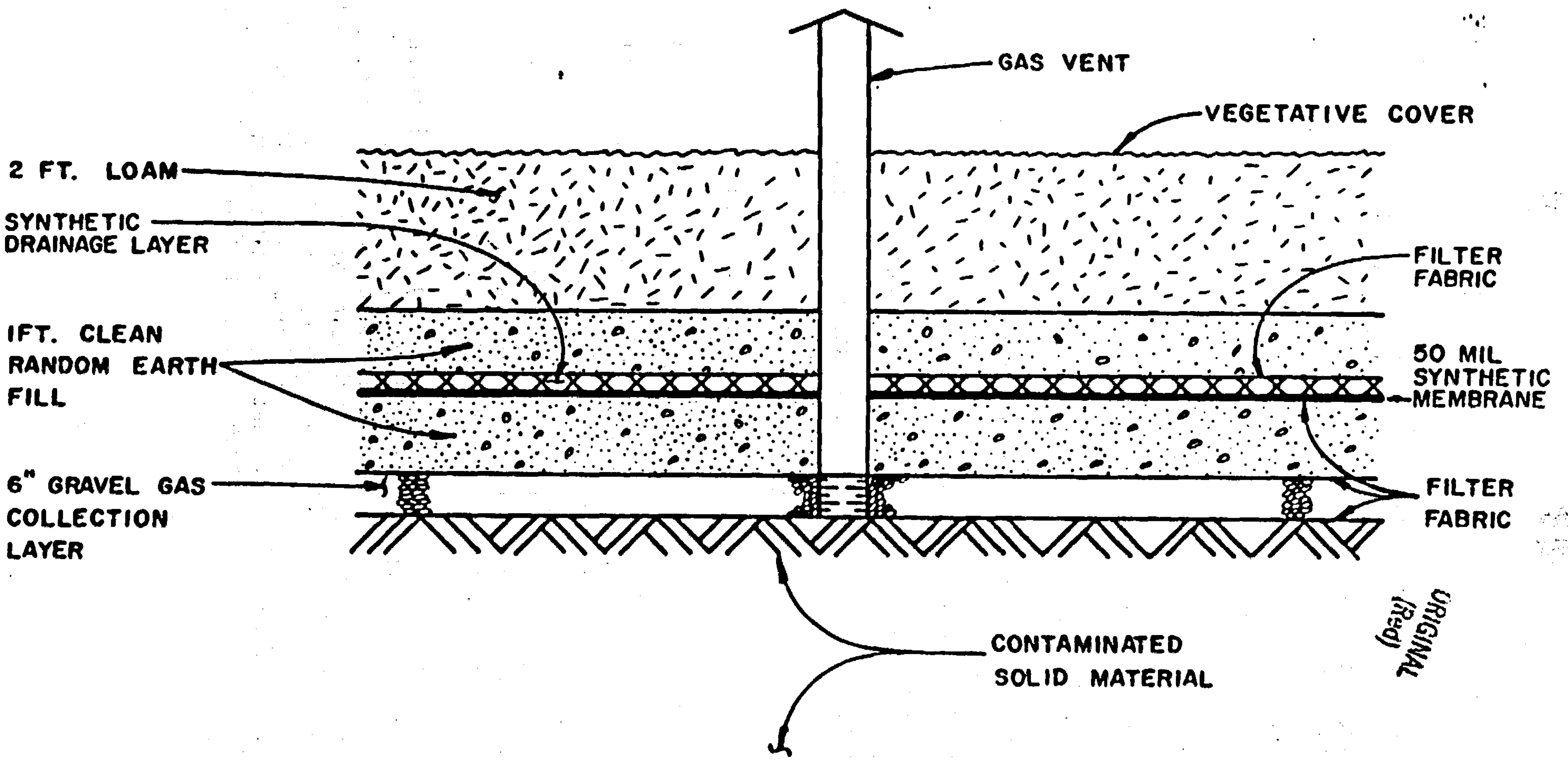


FIGURE 5-12
PA-TYPE MULTI-LAYER CAP
DORNEY ROAD FS

5.3.5 Alternative No. 4: Onsite RCRA Landfill

This alternative would provide complete, three-dimensional containment of waste material, thus minimizing risks to both human health and the environment. The contaminated solid media would, however, remain on site indefinitely, posing potential future risks. The following elements are incorporated in this alternative:

- Perimeter Fence
- Deed Restrictions
- Surface Water Elimination
- Excavation
- RCRA-Type Landfill
- RCRA-Type Multi-Layer Cap
- Runon/Runoff Controls
- Runoff Monitoring
- Groundwater Monitoring

Figures 5-13 and 5-14 show a plan view and a cross section of the site with the proposed remedial actions. Implementation of technologies not previously addressed is discussed in detail below.

Excavation: All contaminated solid material detected during the remedial investigation would be excavated and placed in a lined landfill constructed on site. Excavation would be performed in stages to allow simultaneous construction of the landfill bottom liner.

A total of approximately 1.5 million cu. yds. of contaminated waste would be excavated from depths ranging from 18 to 48 ft. Much of the excavation would require a dragline due to the depth and volume of material. In each phase of construction, the excavated material would be temporarily stored in a covered storage area where it would be dewatered under its own weight. Water lost during dewatering would be permitted to evaporate and any remaining water would be collected, treated, and discharged. The bottom of the waste pit would be smoothed and sloped to provide a foundation for construction of the bottom liner system. After the bottom liner is constructed, the dewatered waste would be backfilled within the liner and compacted. While the methods employed for excavation are well developed and in common use, staging of the removal with simultaneous liner construction would require complex design.

RCRA-Type Landfill: A liner system conforming to RCRA guidelines would be constructed to contain all contaminated material on site. This liner system would extend across the rectangular central portion of the site and material from the western tongue and northern extension of the existing landfill would be placed within the liner. The western tongue and northern extension would be backfilled with clean fill, thus reclaiming these areas. Although this is not practical for the capping alternative, as evaluated previously, it is feasible with this alternative since excavation of all contaminated material is required in any case.

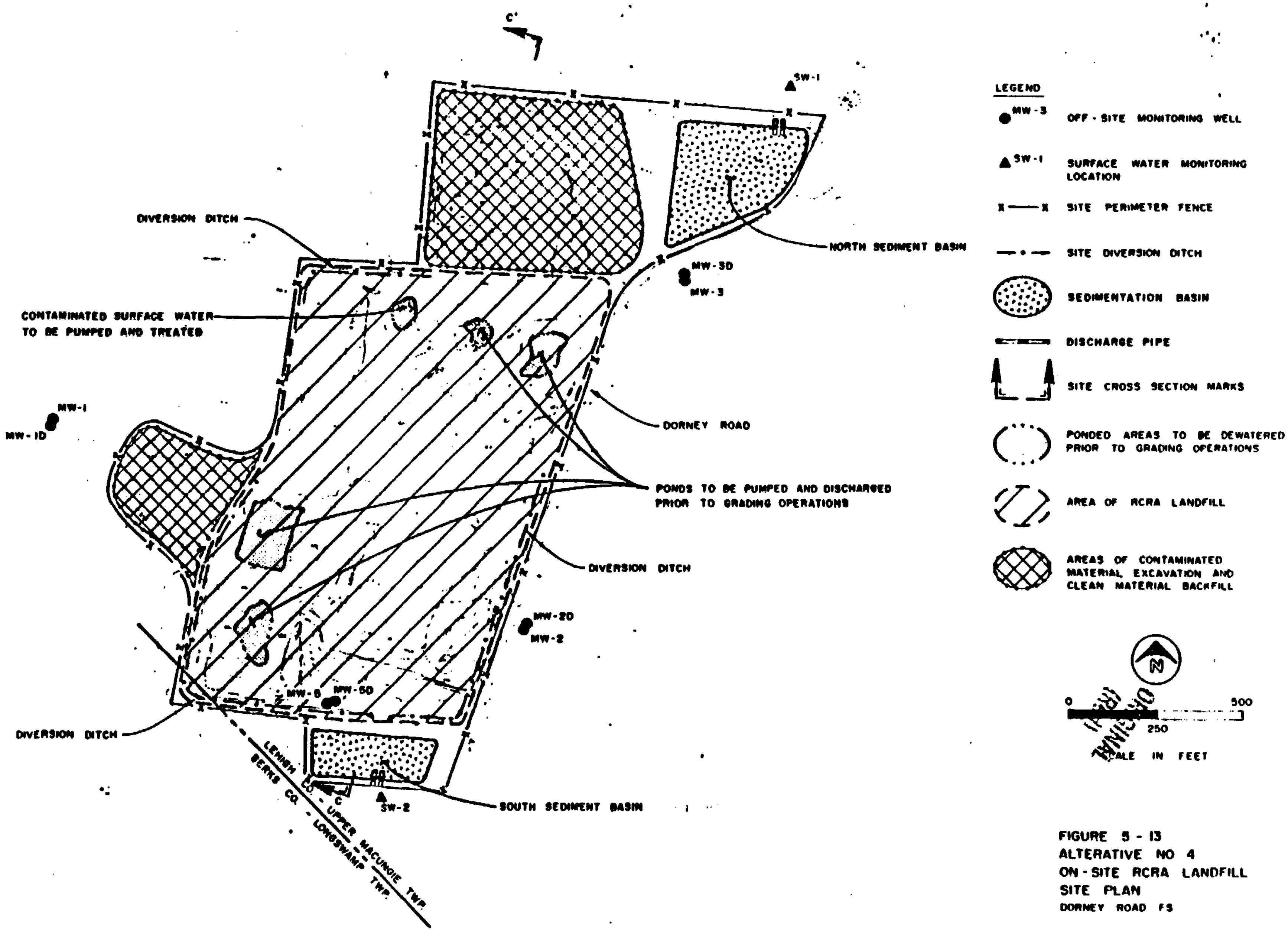
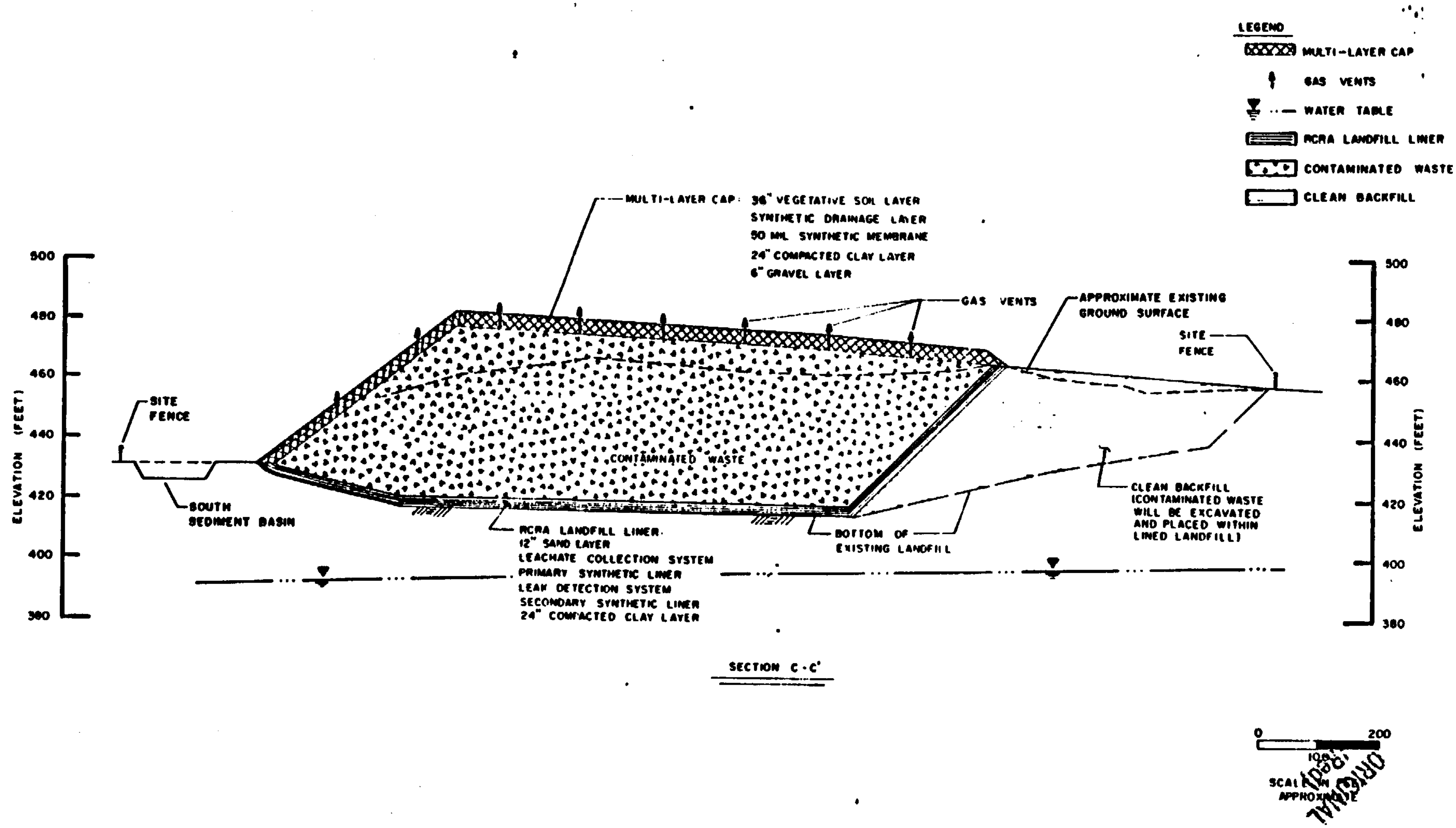


FIGURE 5 - 13
ALTERATIVE NO 4
ON-SITE RCRA LANDFILL
SITE PLAN
DORNEY ROAD FS



ORIGINAL (Red)

FIGURE 5-14
ALTERNATIVE NO. 4
ON-SITE RCRA LANDFILL
GENERALIZED SECTION C-C'
DORNEY ROAD FS

ORIGINAL (Red)

A RCRA-compliant landfill would consist of a continuous bottom liner system and multi-layer cap. The cap would be the same as that discussed under Alternative No. 3, and the bottom liner would consist of the following: 2-ft. compacted clay layer, primary and secondary 50-mil flexible synthetic liners, leachate collection system, and leak detection system. Figure 5-15 shows a schematic cross section of the bottom liner system. The leachate collection system functions to collect and remove leachate from the waste material placed in the landfill. Leachate would be pumped from the system and hauled to a public or private treatment facility for disposal. The leak detection layer is designed to rapidly convey any leachate which may leak through the primary liner to a sump, thus providing quick detection of liner failure. A secondary liner system consisting of a synthetic membrane and a compacted clay layer, provides additional containment in the event of primary liner failure.

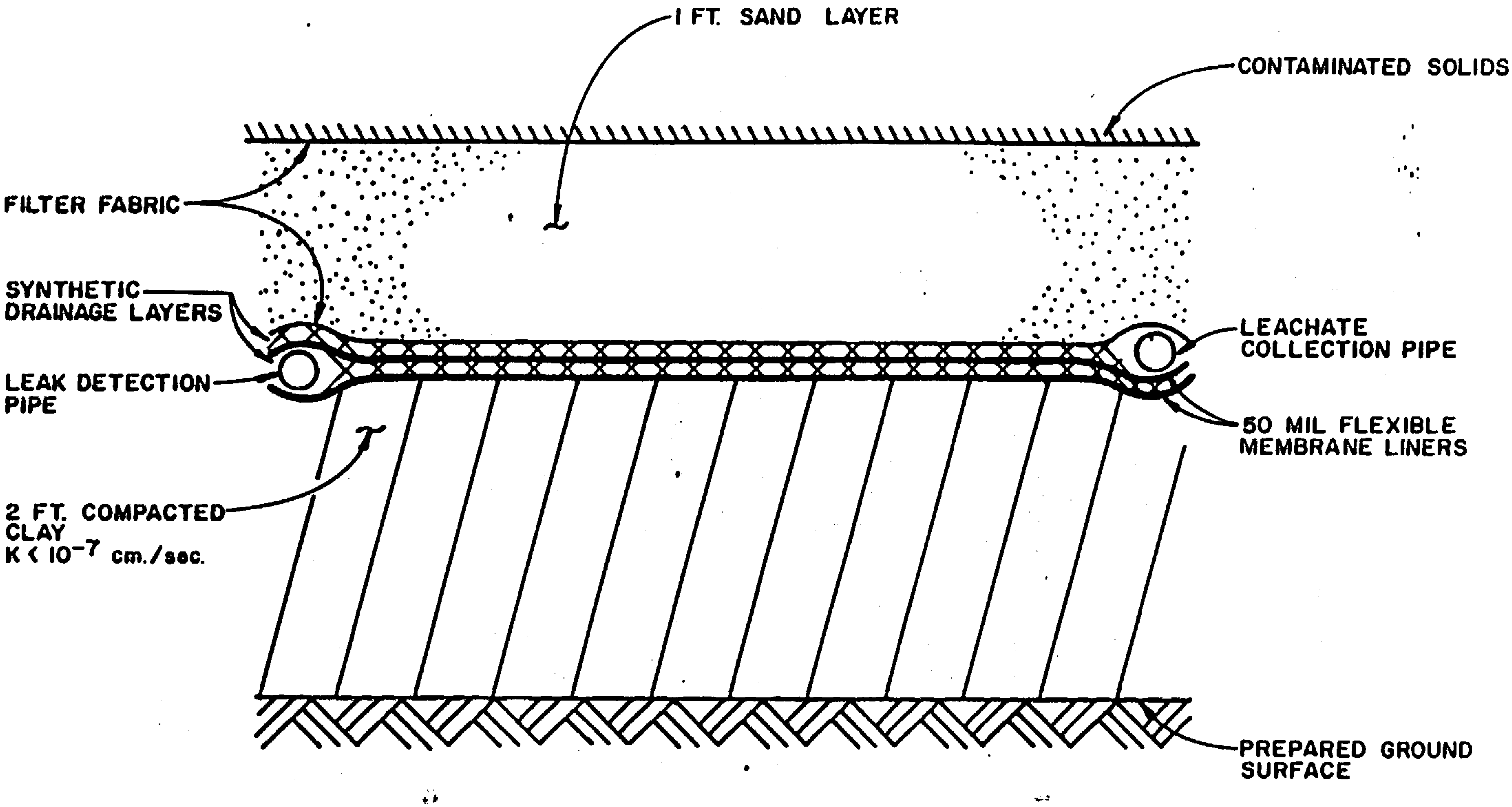
Construction of the liner system would be performed in stages during excavation. Excavated material would be temporarily stockpiled on site while the bottom liner is excavated, then placed within the liner system and covered with the multi-layer cap. The synthetic membrane of the cap would be thermally welded to the primary synthetic membrane of the bottom liner system to provide total containment of the waste in three dimensions. The bottom of the proposed landfill would be at about 420 ft. above mean sea level (MSL) and the top would be mounded approximately 20 ft. above the present ground surface. The mounding would be necessary to accommodate the material from the north and west tongues. The groundwater surface beneath the site would range from about 390 ft. MSL in the south to 400 ft. MSL in the north after the removal of the onsite ponds. The proposed construction of the landfill would allow a 20 ft. interval between the bottom of the liner system and the water table, which is greater than the minimum 6-ft. interval required under RCRA.

The construction process would be extremely complex because it would be performed in multiple phases with simultaneous excavation, backfill, and cap construction. Similar projects have, however, been successfully completed. The construction time for completion of the landfill, including excavation, bottom liner construction, backfill of waste, and capping, would be approximately five years. Ongoing maintenance requirements would include continued pumping of the leachate collection system and monitoring of the leak detection system, in addition to the cap maintenance discussed for the previous alternative.

5.3.6 <u>Alternative No. 5: Onsite Incineration</u>

Implementation of this alternative would provide complete destruction of organic contaminants and subsequent containment of ash residue containing inorganic contaminants. The result would be maximum protection of both human health and the environment from risks posed by the contaminated solid media. The following components are included in this alternative:

- o Perimeter Fence
- o Deed Restrictions
- o Surface Water Elimination



ORIGINAL (Red)

FIGURE 5-15
TYPICAL RCRA LANDFILL LINER
DORNEY ROAD FS

- Excavation
- Incineration
- RCRA-Type Landfill
- RCRA-Type Multi-Layer Cap
- Runon/Runoff Controls
- Runoff Monitoring
- Groundwater Monitoring

ORIGINAL (Red)

Figures 5-16 and 5-17 show implementation of the above components in plan view and cross section, respectively. The significant difference between this alternative and Alternative No. 4 is that contaminated solids would be incinerated prior to placement in a smaller RCRA-type landfill. Containment of the ash would be necessary since inorganic contaminants would not be destroyed during incineration.

Incineration: All contaminated solid material detected during the remedial investigation would be excavated, incinerated, and the remaining ash placed in a RCRA-type landfill on site. A large incinerator capacity would be required to process the contaminated material in a reasonable time. It is estimated that an incinerator capacity of about 450 tons/day would be required to process the estimated total 1,500,000 cu. yds.in a 10 year period, which is about the capacity of a moderate sized municipal solid waste incinerator serving a metropolitan area. The incinerator installation would be constructed on the northeastern portion of the site. A flue gas treatment system would be required to prevent violation of air emissions standards. Preprocessing the wastes by classification and shredding would be required.

Contaminated solids would be excavated at a rate consistent with the incineration rate to minimize storage requirements. A small amount of material would be stockpiled, however, to allow for unexpected decreases in excavation production. Prior to incineration, excavated material would be dewatered and separated to remove large metal trash. Metal trash would be decontaminated and compacted for disposal in the lined landfill, along with the incinerator ash. Water would be collected and treated prior to discharge. After the separation step, the contaminated solids would be shredded to produce a uniform stream for input into the incinerator.

The incineration process would destroy all organic material in the waste, including the organic contaminants. The remaining ash would be reduced to approximately 50% of original waste volume, but would still contain all of the metals originally present. For this reason, disposal of the ash in a RCRA-type landfill would probably be required. Final determination of the required disposal will be dependent on the results of TCLP testing of the ash. It is unlikely, however, given the high metals concentrations in the onsite waste, that standards for waste delisting would be met. The landfill would be constructed in the same manner as previously described, except that gas vents would not be required in the cap since all organic material would be destroyed.

ORIGINAL
(Red)

Excavation and incineration of all contaminated waste on site with construction of a RCRA-type landfill for ash would require about 12 years. The incineration units would have a high operating cost and a high maintenance requirement during their operating life and the ash landfill would require ongoing maintenance as described for Alternative No. 4.

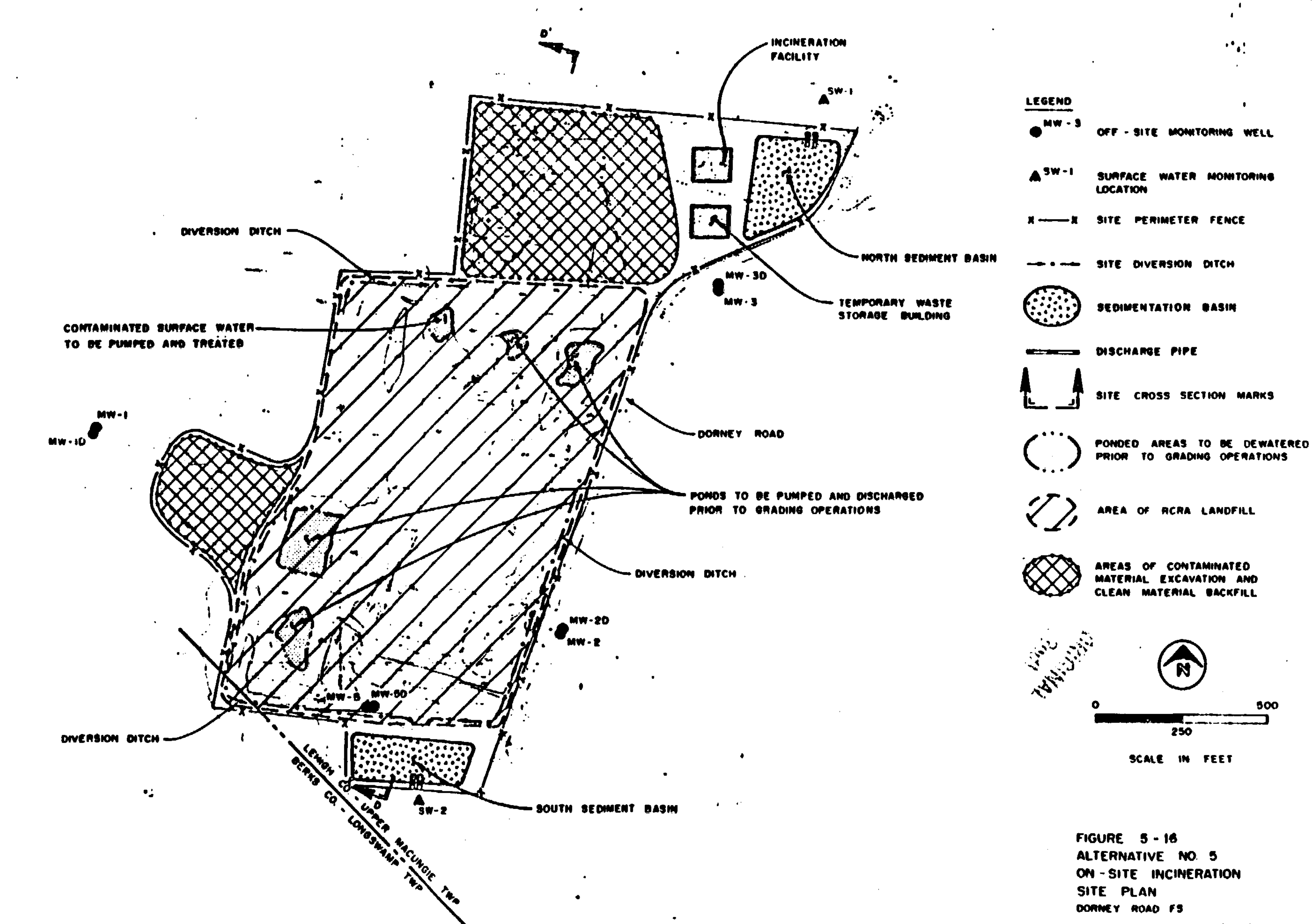


FIGURE 5 - 16
ALTERNATIVE NO. 5
ON - SITE INCINERATION
SITE PLAN
DORNEY ROAD FS

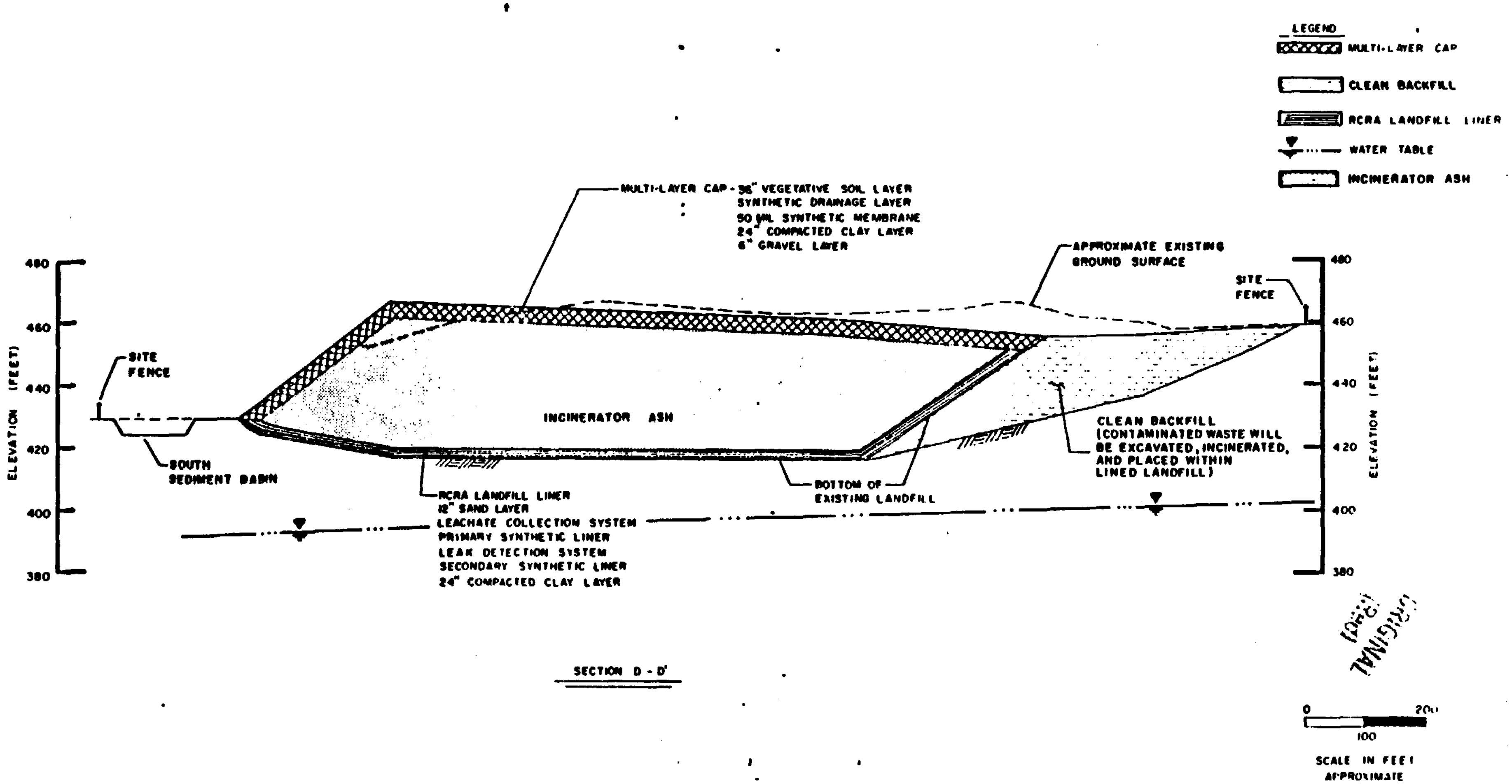


FIGURE 5-17
ALTERNATIVE NO. 5
ON-SITE INCINERATION
GENERALIZED SECTION D - D'
DORNEY ROAD FS

6.0 DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

In this section, each remedial alternative developed in Section 5 is evaluated in detail. The detailed evaluation of each remedial alternative includes the following:

- o Brief description of the remedial alternative emphasizing the application of the technologies.
- o Detailed evaluation considering effectiveness, implementability, and cost of the remedial alternative, emphasizing the factors outlined in CERCLA Section 121(b), as amended.

6.1 EVALUATION PROCESS

The remedial alternatives are examined with respect to requirements stipulated in CERCLA as amended, OSWER Directive No. 9355.0-19 ("Interim Guidance on Superfund Selection of Remedy," December 24, 1986), and factors described in OSWER Directive No. 9355.3-01 ("Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA," March, 1988). The evaluation criteria and associated statutory considerations of Section 121(b) of CERCLA, Title I, as amended, are:

- o Short-term effectiveness (121(b)D,G)
- o Long-term effectiveness and permanence (A,C,D)
- o Reduction of toxicity, mobility, or volume (C)
- o Implementability
- o Cost (E,F)
- o Compliance with ARARs (B)
- o Overall protection of human health and the environment
- o State acceptance
- o Community acceptance

Each remedial alternative is evaluated with respect to the above factors, as described in the following sections. At the completion of all detailed analyses, a section is included in which the statutory factors and criteria described in OSWER Directive No. 9355.3-01 are compared for each alternative to assist in the remedy selection process.

6.1.1 Short-Term Effectiveness

The short-term effectiveness of a remedial alternative is evaluated relative to its effect on human health and the environment during implementation of the remedial action. The short-term effectiveness assessment is based on four key factors:

- o Risk that occurs to the community during implementation of the remedial action;
- o Risk to workers during implementation of the remedial action;

- Potential for adverse environmental impacts to occur as a result of implementation of the remedial action; and

- Time until remedial response objectives are achieved.

6.1.2 Long-Term Effectiveness and Permanence

Evaluation of a remedial alternative relative to its long-term effectiveness and permanence is made considering the risks remaining at the site after the response objectives have been met. The assessment of long-term effectiveness is made considering the following three major factors:

- The magnitude of the residual risk remaining from untreated waste or treatment residues at the completion of remedial activities;

- An assessment of the adequacy and suitability of containment systems and/or institutional controls used to manage treatment residues or untreated waste remaining at the site; and

- An assessment of the long-term reliability of containment systems and/or institutional controls to provide continued protection from treatment residues or untreated waste.

6.1.3 Reduction of Toxicity, Mobility and Volume (TMV)

This evaluation criterion addresses the statutory preference for remedial actions that employ treatment technologies that permanently and significantly reduce toxicity, mobility, or volume of the hazardous substances as their principal element. The evaluation should consider the following specific factors:

- The treatment processes, the remedies they will employ, and the materials they will treat;

- The amount of hazardous materials that will be destroyed or treated, including how principal threat(s) will be addressed;

- The degree of expected reduction in toxicity, mobility, or volume, measured as a percentage of reduction (or order of magnitude) when possible;

- The degree to which the treatment will be irreversible; and

- The type and quantity of treatment residuals that will remain following treatment.

6.1.4 Implementability

The remedial alternatives must be evaluated to estimate the degree to which each can satisfy implementability criteria. Implementability refers to the technical and administrative feasibility of implementing an alternative, and the availability of various materials and services required during its implementation. The following factors must be considered during the implementability analysis:

- <u>Technical Feasibility</u>: The relative ease of implementing or completing an action based on site specific constraints, including the use of established technologies. The following should be considered:

  - Ability to construct the alternative as a whole (constructability).
  - Reliability, or the ability of a technology to meet specified process efficiencies or performance goals.
  - Ease of undertaking future remedial actions that may be required.
  - Ability to monitor the effectiveness of the remedy.

- <u>Administrative Feasibility</u>: Activities needed to coordinate with other offices and agencies (e.g., obtaining permits for offsite activities or rights-of-way for construction).

- <u>Availability of Services and Materials</u>: The availability of the technologies (materials or services) required to implement an alternative. The following items should be considered:

  - Availability of adequate offsite treatment, storage capacity, and disposal services.
  - Availability of necessary equipment and specialists and provisions to ensure any necessary additional resources.
  - Timing of the availability of technologies under consideration.
  - Availability of services and materials, plus the potential for obtaining competitive bids, which may be particularly important for innovative technologies.

6.1.5 Cost

For each remedial alternative, a detailed cost estimate is developed in accordance with procedures in the Remedial Action Costing Procedures Manual (USEPA, 1985). Cost estimates for each alternative are based on conceptual engineering and analyses, and are expressed in terms of 1988 dollars. All costs are rounded to two significant figures. The cost estimate for a remedial alternative consists of four principal elements:

- Capital costs
- Operation and maintenance costs
- Five year review costs
- Analysis of present worth

1. Capital Costs: Capital costs consist of direct (construction) and indirect (non-construction and overhead) costs. Direct costs include costs for equipment, labor and materials incurred to develop, construct and implement a remedial action. Indirect costs are expenditures for engineering, financial, and other services that are not actually a part of construction, but are required to implement a remedial alternative. In this Feasibility Study, indirect costs will include the following items:

   - Health and safety items;
   - Permitting and legal fees;
   - Services during construction; and
   - Engineering and design.

   These items are included in the detailed cost analysis as separate line items, and are expressed as a percentage of direct capital costs. Additionally, two contingency factors (bid and scope) are also included in the cost estimates to account for factors that cannot be anticipated or estimated.

2. Operation and Maintenance (O & M) Costs: O & M costs refer to post-construction costs necessary to ensure the continued effectiveness of a remedial action. They typically refer to long-term power and material costs (such as the operational costs of a water treatment facility), equipment replacement costs, and long-term monitoring costs.

3. Costs for Five-Year Review: CERCLA, as amended, Section 121(c) states that a five-year review of a remedial action is required if that remedial action results in hazardous contaminants remaining on site. Costs associated with five year reviews are for a period of 30 years and apply to all alternatives developed.

4. Present Worth Analysis: This assessment is used to evaluate the capital and O & M costs of a remedial alternative on a present worth basis. This analysis allows the comparison of remedial alternatives on the basis of a single cost representing an amount that, if invested in the base year and

disbursed as needed, would be sufficient to cover all costs associated with the remedial action over its planned life. A 30-year performance period is assumed for present worth analyses. Discount rates of 3, 5 and 10 percent are assumed for base calculations.

The remedial alternative cost estimates developed for the feasibility study are intended to provide an additional basis for comparison between alternatives. These are order-of-magnitude estimates based on current costing information available at the time the estimate was prepared. They are intended to reflect actual costs with an accuracy of -30 to +50 percent. Final costs of assembled alternatives will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, final project scope, final project schedule, continuity of personnel, engineering between the feasibility study and final design, and other variable factors. As a result, the final alternative costs will vary from the estimates presented in this report. However, these factors are not expected to affect the relative cost differences between alternatives.

A cost estimate summary table giving a detailed account of all capital, O & M, and five-year review costs, along with a present worth analysis is provided for each remedial alternative.

6.1.6 Compliance with ARARs

This evaluation is performed to assess how each alternative complies with applicable or relevant and appropriate Federal and State requirements, as defined in CERCLA Section 121. The analysis summarizes which requirements are applicable or relevant and appropriate to an alternative. The following items should be considered for each alternative:

- Compliance with chemical-specific ARARs (e.g., MCLs). This factor addresses whether the ARARs can be met; and, if not, whether a waiver may be appropriate.

- Compliance with action-specific ARARs (e.g., RCRA minimum or PASWR technology standards). It must be determined whether ARARs can be met or waived.

- Compliance with location-specific ARARs (e.g., preservation of historic sites). As with other ARAR-related factors, this involves a consideration of whether the ARARs can be met or whether a waiver is appropriate.

It should also consider whether or not an alternative is in compliance with appropriate criteria, advisories, and guidances. This involves a consideration of how well the alternative meets Federal and State guidelines that are not ARARs.

ORIGINAL (Red)

6.1.7 Overall Protection of Human Health and the Environment

In this evaluation, an overall assessment of protection (of human health and the environment) is made, based on a composite of factors assessed under other evaluation criteria. Those specifically considered are short-term effectiveness, long-term effectiveness and permanence, and compliance with ARARs. For each alternative, the evaluation should include:

- How each source of contamination is to be eliminated, reduced or controlled; and
- How site risks are to be reduced.

6.1.8 State Acceptance

State acceptance will not be evaluated as the Pennsylvania DER is the lead agency; State approval is inherent.

6.1.9 Community Acceptance

When community positions on specific alternatives have been documented during preparation of the RI/FS, the detailed analysis should address features of the remedial activities on which the community has expressed a position.

6.2 DESCRIPTION AND ASSESSMENT OF SOURCE CONTROL REMEDIAL ALTERNATIVES

Each of the alternatives presented in Section 5.0 were developed as source control remedial alternatives to address the site contamination related to the onsite soils and subsurface waste, and surface water.

The Minimal/No Action Alternative (No. 1) is at one end of the range of alternatives. Alternative 1 consists of limiting access to the site and instituting use restrictions. It includes no provisions for treatment or containment of contaminated solids.

Three containment alternatives have been developed. Alternative No. 2 involves onsite containment using a soil cover. Alternative Nos. 3A and 3B provide containment using a multi-layer cap system. The cap system would significantly reduce contaminant migration. Alternative No. 4 includes the excavation and placement of contaminated solids on an onsite RCRA-complaint landfill.

One treatment alternative has been developed. Alternative No. 5 provides the maximum degree of protection with the incineration of all contaminated solids which eliminates organic contaminants present in the treated media.

All alternatives except the Minimal/No Action Alternative (No. 1) include the elimination and treatment of onsite surface water and the ancillary technologies of runoff and groundwater monitoring.

6.2.1 <u>Alternative No. 1: Minimal/No Action</u>

Under the Minimal/No Action Alternative, no remedial action would take place at the site. The major components of this alternative include:

- o Installation and maintenance of a chain link perimeter fence.
- o Establishment of institutional controls (land use/deed restrictions).
- o Performance of a site review every five years.

A plan view of the site showing implementation of Alternatives is shown on Figure 6-1.

6.2.1.1 <u>Short-Term Effectiveness</u>

During implementation of this alternative, it is anticipated that no risk will occur to local residents and implementation should not result in any potential for adverse environmental impacts. The only component of this alternative that involves implementation is the installation of the perimeter fence. Workers involved in this construction would not likely be exposed to any contaminants since the fence would be installed outside of currently identified limits of contamination.

It is anticipated that all components of Alternative No. 1 could be implemented within less than one year of the signing of the ROD.

6.2.1.2 <u>Long-Term Effectiveness and Permanence</u>

<u>Magnitude of Residual Risk</u>: Since no remedial actions would be implemented at the site for Alternative No. 1, the risks identified in the PHE, as summarized in Section 1.4 of this report, would not be mitigated to a large extent. The risks posed by the contaminated onsite solids and onsite surface water through dermal absorption and incidental ingestion by teenagers and adults are at or in excess of a 10^{-6} excess cancer risk for current use.

Minor reduction of risk is achieved in this alternative by access restrictions and institutional controls. Fencing the specified areas, along with institutional controls, should reduce the current and future risks to hunters and/or residents due to direct contact and incidental ingestion. Current and future risks due to groundwater ingestion remain unmitigated.

<u>Adequacy of Controls</u>: It is probable that the fence will serve to reduce access to contaminated areas, thereby reducing direct contact risks. Land use and deed restrictions may be somewhat less effective, as they could be disregarded by individuals unfamiliar with them, or people intent on performing certain actions in violation of the restrictions. Long-term management would include semi-annual site inspections and five year reviews. Long-term monitoring would include groundwater, air, surface water, and sediment monitoring on a semi-annual basis. Operation and maintenance functions to be performed would include the site inspections, fence repair as needed, and long-term monitoring.

Reliability of Controls: The fencing and institutional controls should be effective in reducing the risks associated with direct contact with contaminated materials in the specified areas. The fence will require periodic inspection and maintenance to function efficiently as a physical barrier. If the fence were to become non-functional and would allow unrestricted access to the site, the health risks would be the same as those specified in the PHE.

6.2.1.3 Reduction of Toxicity, Mobility, and Volume (TMV)

The TMV of the site contaminants are not reduced by this alternative.

6.2.1.4 Implementability

Technical Feasibility: The site perimeter fence installation is a common construction procedure involving no foreseeable difficulties. In terms of reliability, it is likely that the site fence will succeed in reducing access of individuals to the restricted areas. Precedent and procedures exist for the legal enactment of deed restriction. The enforcement of deed restrictions in the future is uncertain. Monitoring is demonstrated procedure which is reliable for detecting contaminant migration; however, a lapse of time may occur between onset of migration and detection or between detection and implementation of a mitigating action. The effective use of site fencing and monitoring requires continual, ongoing maintenance and operation.

If additional remedial actions are required in the future, no components of Alternative No. 1 should serve to affect the implementation of such actions.

All potential migration pathways should be effectively monitored by the proposed monitoring program.

Administrative Feasibility: In order to implement the institutional controls, coordination with Lehigh County authorities will likely be required. Long-term coordination between the USEPA and the State of Pennsylvania will also be necessary.

Availability of Services and Materials: All components of Alternative No. 1 utilize common construction items and procedures, and routine sampling procedures and analyses.

6.2.1.5 Cost

The total present worth of Alternative 1 (over a 30 year period at a 5% discount rate) is approximately $760,000. Operation and maintenance accounts for the largest portion of the present worth at $600,000, while capital costs and five year reviews represent costs of $120,000 and $42,000, respectively. A complete cost summary of Alternative 1 is presented in Table 6-1. Capital expenditures would consist of perimeter fence construction costs and legal fees for implementing deed restrictions. The operation and maintenance costs would be primarily due to semi-annual monitoring (about $580,000 over the 30

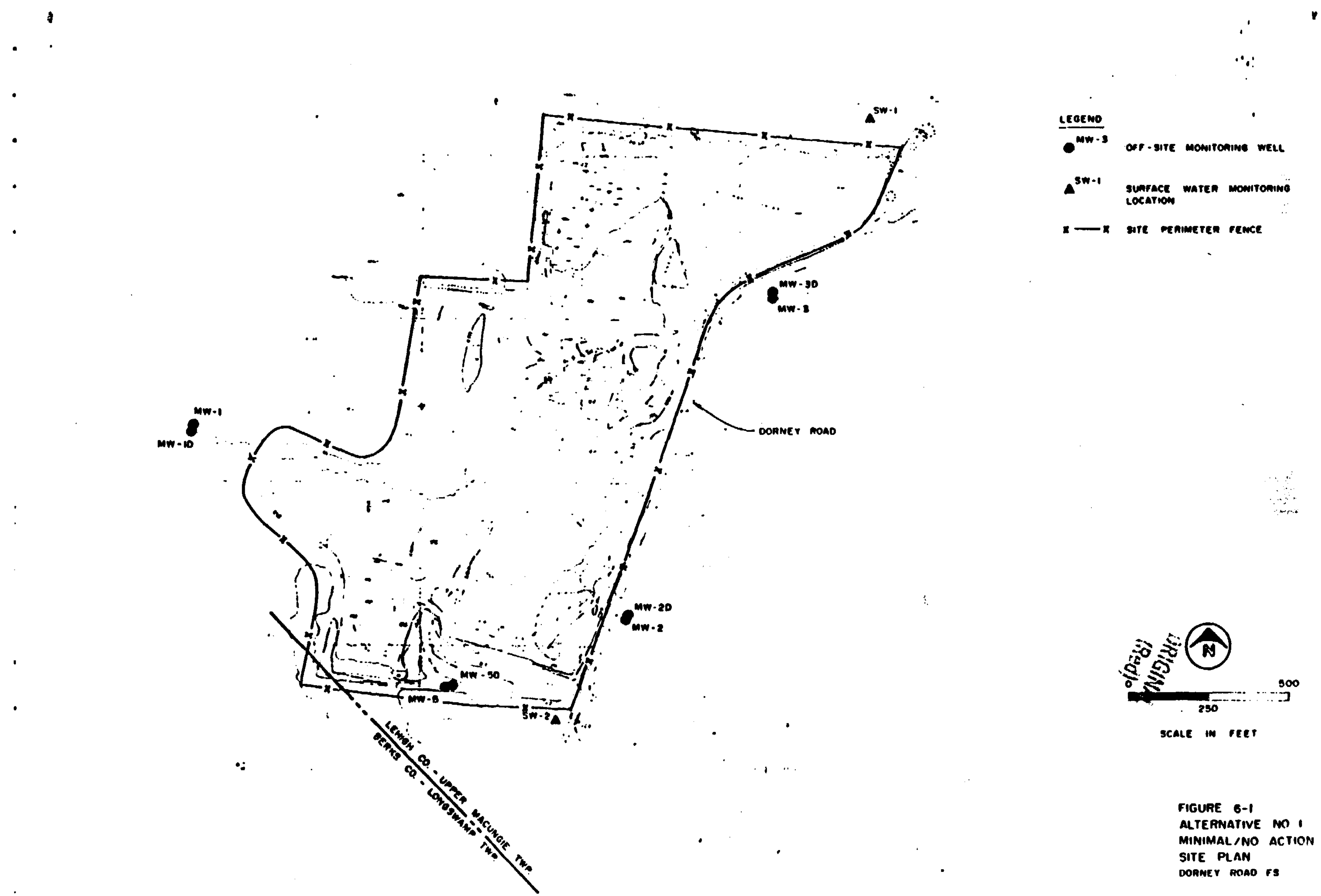


FIGURE 6-1
ALTERNATIVE NO 1
MINIMAL/NO ACTION
SITE PLAN
DORNEY ROAD FS

TABLE 6-1
Cost Estimate Summary
Alternative No. 1
Minimal/No Action

Item	Capital Cost	Annual O & M	Present Worth 30 Years O&M/Replacement 3%	5%	10%
I. ACCESS RESTRICTIONS					
Perimeter Fence	$86,000	$1,000	$20,000	$15,000	$9,000
Deed Restrictions	$1,000				
II. MONITORING					
Runoff Monitoring		$12,000	$240,000	$180,000	$110,000
Groundwater Monitoring		$26,000	$510,000	$400,000	$250,000
Five Year Review			$55,000	$42,000	$23,000
CONSTRUCTION SUBTOTAL	$87,000		$830,000	$640,000	$390,000
Health and Safety (10%)	$9,000				
Bid Contigency (5%)	$4,000				
Scope Contingency (5%)	$4,000				
CONSTRUCTION TOTAL	$100,000				
Permitting & Legal (0%)	$0				
Services During Construction (5%)	$5,000				
TOTAL IMPLEMENTATION COST	$110,000				
Engineering & Design (5%)	$6,000				
TOTAL CAPITAL COSTS	$120,000				
PRESENT WORTH			$950,000	$760,000	$510,000

000? .

year period evaluated). The cost for periodic review every five years was based on an unit cost of $15,000 per review.

6.2.1.6 <u>Compliance with ARARs</u>

Requirements for fence construction and monitoring activities could be met by this alternative. This alternative does not satisfy health and environmental ARARs because the public and environmental health risks identified are not remediated.

6.2.1.7 <u>Overall Protection of Human Health and the Environment</u>

This alternative provides a minimum of protection to human health and the environment. Installation of fencing and implementation of institutional restrictions will reduce the opportunity to contact the contaminated solids and surface water. Continued offsite migration of contaminants by surface routes will continue to occur. Furthermore, contaminants will continue to leach to groundwater. Monitoring will be implemented to observe contaminant migration, but an indeterminate amount of time would elapse between detection and the implementation of mitigating measures. During this time, public health and environmental hazards would continue to exist.

6.2.1.8 <u>Community Acceptance</u>

To be addressed after public comment period.

6.2.2 <u>Alternative No. 2: Soil Cover</u>

Alternative No. 2 involves the following major components:

o Installation and maintenance of a chain link perimeter fence.
o Establishment of institutional controls (land use/deed restrictions).
o Surface water disposal and regrading.
o Application of a vegetated soil cover over the entire site.
o Performance of a site review every five years.

In this alternative, a 2 ft. thick soil cover would be constructed over the the entire 34 acre area of concern defined in Section 5.2. A plan view of this alternative is presented on Figure 6-2. The northeastern corner of the site not covered by the soil layer is essentially a weed covered area where no site related contamination problem was identified during the RI. Site preparation will include disposal of onsite surface water and surface regrading prior to installation of soil cover consisting of clean soil borrow compacted to a minimum uniform depth of 2 ft. A vegetative cover will be established and maintained.

In addition, the two ponds in the southwest of the site would be drained to the local watershed, and the ponded water in the northwest area of the site would be transported to a private RCRA treatment facility for treatment. Sedimentation ponds would be constructed at the north and south surface water discharge points to limit the sediment load to the receiving drainage.

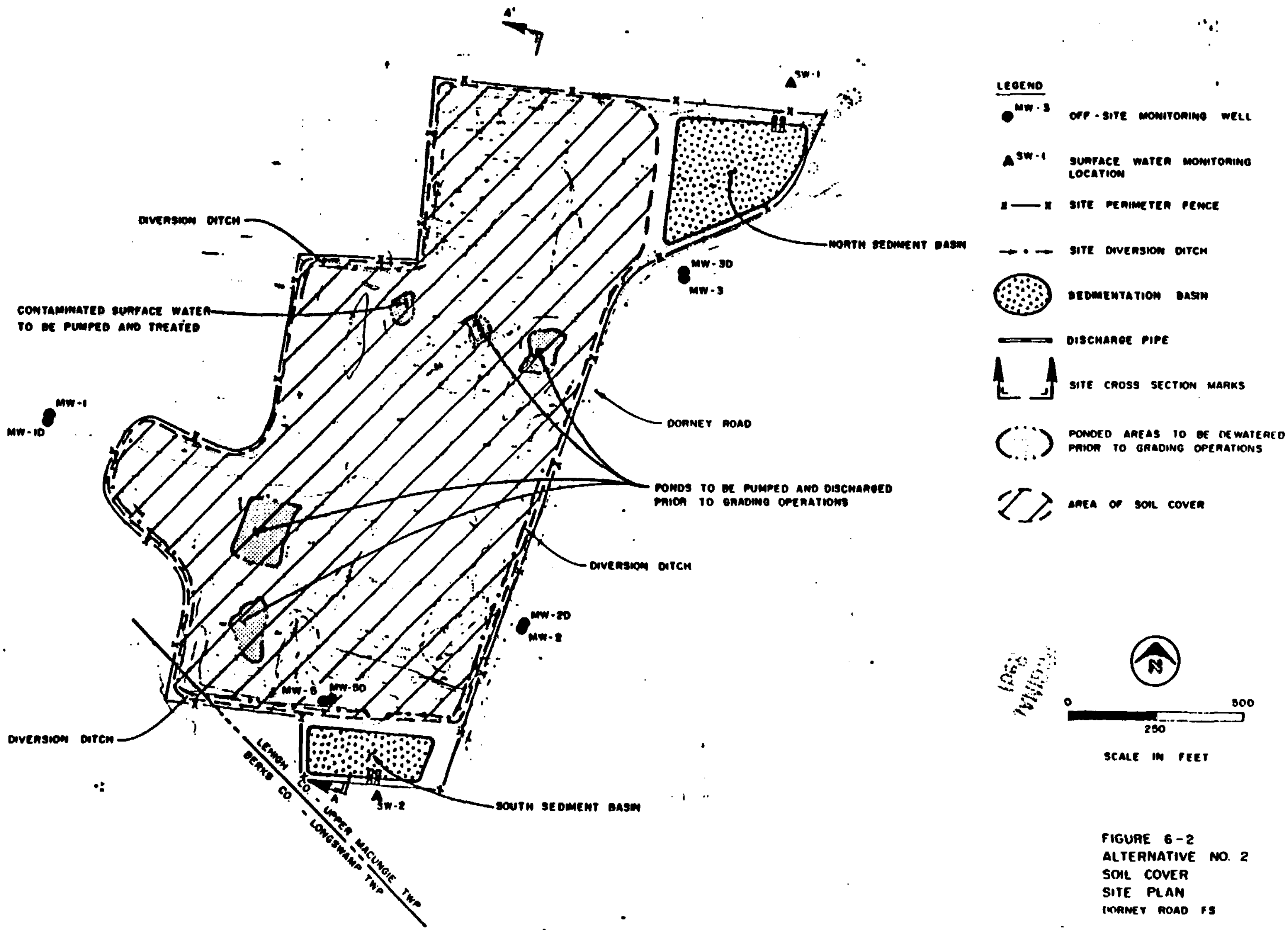


FIGURE 6-2
ALTERNATIVE NO. 2
SOIL COVER
SITE PLAN
DORNEY ROAD FS

6.2.2.1. Short-Term Effectiveness

There are no residents living within 1,000 ft. of the site. Therefore, implementation of this alternative should not expose any local population to increased potential risk. Implementation of this alternative may result in a short-term adverse environmental impact by the disruption of a migratory waterfowl resting area. Migratory waterfowl and other wildlife currently residing near the site should be able to relocate easily since the surrounding areas provide sufficient similar habitat.

Workers responsible for implementing this remedial action may be exposed to risks associated with dermal contact and incidental ingestion of contaminated solids or surface water during regrading and surface water disposal efforts. Risks will be mitigated by ensuring that workers are outfitted with proper personal protection equipment. Potential risks due to inhalation of volatiles or fugitive dust are estimated to be minimal based on the results of the RI air monitoring and surface soil screening activities.

It is anticipated that all components of Alternative No. 2 could be implemented within two years of the signing of the ROD.

6.2.2.2 Long-Term Effectiveness and Performance

Magnitude of Residual Risk: The implementation of the containment technologies in Alternative No. 2 would serve to mitigate a number of the risks identified in the PHE.

The risks to hunters or residents resulting from direct contact or incidental ingestion of contaminated solids are mitigated by removal of the contact pathway. Assuming proper functioning of the soil cover, the residual risk should be less than 10^{-6}. Installation of the soil cover effectively isolates the contaminated solids from potential receptors, thereby greatly reducing the potential risks. As the contaminated soils and subsurface waste are not treated, a failure or breach of the soil cover would result in the reoccurrence of the health risks for direct contact or incidental ingestion scenarios as described in Section 1.4 of this report.

Additionally, the contaminated surface water that resulted in a contact risk exceeding 10^{-6} will be eliminated from the site by draining of the pond with subsequent treatment of the water offsite.

Adequacy of Controls: The vegetated soil cover should be effective in preventing direct contact with contaminated solids. Long-term management activities would include semi-annual inspections and monitoring, and five year reviews, as previously described. Long-term monitoring requirements are the same as those previously discussed for Alternative No. 1. Operation and maintenance activities would include semi-annual visual inspection of the soil cover, vegetation control, the replacement of topsoil lost by erosion, and occasional reseeding of bare areas. Once the water is removed from the ponded area and the low area is filled during regrading, the surface water remedial action will be permanent.

Reliability of Controls: The topsoil layer must be periodically repaired to replace topsoil lost by erosion, and reseeding activities must occasionally be performed. If the soil cover should somehow be breached, the risks associated with direct contact and incidental ingestion would be similar to those under the minimal no action alternative. The elimination of the onsite pond is a reliable method of mitigating potential public health hazards.

6.2.2.3 Reduction in Toxicity, Mobility and Volume

ORIGINAL (Red)

There is a slight reduction in the TMV of onsite contaminants by the elimination of the contaminated onsite surface water. The TMV of the remainder of the site contaminants are not reduced by this alternative.

6.2.2.4 Implementability

Technical Feasibility: All components of Alternative No. 2 utilize relatively common construction equipment and materials. Fence installation is a relatively simple construction item. Construction of the soil cover should not prove to be difficult. Pond elimination and offsite treatment at a RCRA facility are commonly used technologies for site remediation.

The reliability of site fencing, deed restrictions, and monitoring has been previously discussed. The soil cover should be very reliable in preventing contact with contaminated solids and removal of the contaminated surface water with regrading and maintenance will permanently eliminate ponding onsite.

If additional remedial actions are deemed necessary at some time in the future, the soil cover should have little effect on such actions. The soil cover represents a simple physical barrier that could be easily removed as necessary using standard construction equipment.

All potential migration pathways will be effectively monitored by the proposed monitoring program.

Administrative Feasibility: Implementation of the institutional controls will require coordination with officials of Lehigh County and local townships. Long-term coordination between the USEPA and State of Pennsylvania will also be necessary.

Availability of Services and Materials: All components of Alternative No. 2 utilize readily available common construction items and procedures, and routine sampling procedures and analyses.

6.2.2.5 Costs

The total present worth for implementation of Alternative 2 is $6,900,000 assuming a 5% discount rate over a 30 year period. The majority of this cost (about $5,300,000) is due to capital expenditures. Table 6-2 provides a summary of capital, O & M and periodic review costs, along with present worth analysis.

TABLE 6-2
Cost Estimate Summary
Alternative No. 2
Soil Cover

Item	Capital Cost	Annual O & M	Present Worth 30 Years O&M/Replacement 3%	5%	10%
I. ACCESS RESTRICTIONS					
Site Fence	$86,000	$1,000	$20,000	$15,000	$9,000
Deed Restrictions	$1,000				
II. GENERAL SITE PREPARATION					
Equipment Staging Area	$30,000				
Equipment Mob/Demob	$150,000				
Drain Ponds	$1,000				
Treat Contaminated Surface Water	$1,000				
Clearing and Grubbing	$50,000				
Regrading	$710,000				
Runon/Runoff Controls	$160,000	$2,000	$39,000	$31,000	$19,000
III. SOIL COVER					
Compacted Soil Layer	$1,300,000				
Topsoil Layer	$400,000		$1,200,000	$840,000	$410,000 *
Revegetation	$59,000	$1,000	$120,000	$87,000	$44,000 *
IV. MONITORING					
Runoff Monitoring		$12,000	$240,000	$180,000	$110,000
Groundwater Monitoring		$26,000	$510,000	$400,000	$250,000
Five Year Review			$55,000	$42,000	$23,000
CONSTRUCTION SUBTOTAL	$2,900,000		$2,200,000	$1,600,000	$870,000
Health and Safety (10%)	$290,000				
Bid Contigency (15%)	$440,000				
Scope Contingency (20%)	$580,000				
CONSTRUCTION TOTAL	$4,200,000				
Permitting & Legal (5%)	$210,000				
Services During Construction (8%)	$340,000				
TOTAL IMPLEMENTATION COST	$4,800,000				
Engineering & Design (10%)	$480,000				
TOTAL CAPITAL COSTS	$5,300,000				
PRESENT WORTH			$7,500,000	$6,900,000	$6,200,000

* Present worth calculated assuming replacement of the topsoil layer and revegetation every 10 yrs.

Capital Costs: Capital expenditures include surface water removal and disposal, site grading, construction of the soil cover and surface water controls, and fence erection. Also included is the cost to mobilize and demobilize the heavy construction equipment.

O & M Costs: Ongoing maintenance would be required for the perimeter fence, surface water controls, and vegetation cover. The majority of the O & M costs are incurred in semi-annual monitoring ($580,000) as discussed previously, and in the periodic replacement of the topsoil layer and revegetation ($930,000). The topsoil layer would require replacement and revegetation every 10 years due to erosion.

Periodic Review: Periodic reviews would be required every five years since contaminants would be left onsite indefinately. Review costs would be the same as discussed previously.

6.2.2.6 Compliance with ARARs

The containment technologies designed for use in Alternative No. 2 would be designed to achieve applicable ARARs.

6.2.2.7 Overall Protection of Human Health and the Environment

The combined components of this alternative will decrease the potential for direct contact with contaminated soil and wastes and surface water. This alternative will be protective of public health by mitigating the risk from dermal absorption or incidental ingestion of contaminated solids and surface water. Components of this alternative that contribute to this reduction of risk from direct contact with soils include access/deed restriction, site fence, and the installation of the soil cover. Removal of contaminated surface water from the site eliminates the contact hazard associated with the water on the northwest portion of the site. This alternative does not reduce leaching of contaminants to groundwater.

The deed restrictions would eliminate future potential exposure with contaminated soil by limiting future use or excavation of the site. Contaminated solids would be covered with a soil cover, thereby eliminating risks of direct dermal contact or incidental ingestion.

6.2.2.8 Community Acceptance

To be addressed after public comment period.

6.2.3 Alternative Nos. 3A/3B: Multi-Layer Cap

Alternative Nos. 3A/3B involve the same major components as Alternative No. 2, with the exception that a multi-layer cap instead of a vegetated soil cover would be placed over the site. In these alternatives, an impermeable cap designed in accordance with either RCRA or PA State standards will be constructed over the entire 34 acre area of concern defined in Section 5.2. Also included would be elimination of surface water and erection of a perimeter fence as described previously. See Figure 6-3 for a plan of these alternatives.

ORIGINAL (Red)

As part of the cap construction, the south slope faces along the south border of the site will be regraded to increase the elevation of the crest. The current slopes in this area are approximately 15%. The regraded slopes will be maintained at a maximum 15%. The entire surface of the site will be regraded to drain to the northeast. This slope regrading is necessary to provide proper drainage and comply with Pennsylvania solid waste regulations. The overall surface of the site will slope approximately 2% to the northeast. It is estimated that these regrading activities can be accomplished by a track-mounted end loader which will excavate waste material from the outslopes and transport it to the level area above the slopes where it will be spread and compacted. It is estimated that approximately 110,000 cu. yds. of waste material will be regraded.

As discussed in Chapter 5, two cap design options will be evaluated. Construction of a RCRA-compliant cap will be considered as Alternative 3A and a PA State-compliant cap will be considered as Alternative 3B. The RCRA-type cap would include (from the bottom up):

- o 6 in. thick gravel gas collection layer (geotextile fabric above and below)
- o 2 ft. thick clay layer ($K \leq 10^{-7}$ cm/s)
- o 50 mil synthetic liner (geotextile fabric below)
- o Synthetic drainage net (geotextile fabric above)
- o 24 in. thick clean earth fill
- o 12 in. thick topsoil layer

The PA State cap would consist of (from the bottom up):

- o 6 in. thick gravel gas collection layer (geotextile fabric above and below)
- o 12 in. thick clean earth fill foundation course
- o 50 mil synthetic liner (geotextile fabric below)
- o Synthetic drainage net (geotextile fabric above)
- o 12 in. thick clean fill layer
- o 24 in. thick topsoil layer

Either cap would be constructed layer by layer, finishing a layer completely before a subsequent layer is started. Total area to be capped is approximately 34 acres.

As part of a passive methane gas collection and venting system, gas vents will be installed. These vents will consist of PVC pipe slotted within a gravel gas collection layer.

For simplicity of discussion, Alternatives 3A and 3B will be discussed together when they provide identical benefits or disadvantages. In evaluating criteria where the two alternative options provide different degrees of benefit, they are discussed separately.

6.2.3.1 Short-Term Effectiveness

There are no residents living within 1,000 ft. of the site. Therefore, implementation of this alternative should not expose any local population to increased potential risk. Implementation of this alternative may result in a short-term adverse environmental impact by the disruption of a migratory waterfowl resting area. Migratory waterfowl and other wildlife currently residing near the site should be able to relocate easily since the surrounding areas provide sufficient similar habitat.

Workers responsible for implementing the remedial actions may be exposed to risks associated with dermal contact and incidental ingestion of contaminated solids during regrading efforts. Risks will be mitigated by ensuring that workers are outfitted with proper personal protection equipment.
It is anticipated that all components of Alternatives 3A or 3B could be implemented within less than one year of the signing of the ROD.

6.2.3.2 Long-Term Effectiveness and Permanence

Magnitude of Residual Risk: The implementation of the containment technologies in Alternative Nos. 3A and 3B would serve to mitigate a number of the risks identified in the PHE.

The risks to hunters or residents resulting from direct contact or incidental ingestion of contaminated solids are mitigated by removal of the contact pathway. Assuming proper functioning of the cap, the residual risk should be less than 10^{-7}. Installation of the multi-layer cap effectively isolates the contaminated solids from potential receptors, thereby greatly reducing the potential risks.

As the contaminated materials are not treated, a failure or breach of the cap would result in the reoccurrence of the health risks for direct contact and incidental ingestion scenarios as described in Section 1.4 of this report. These risks would result from untreated residual contamination rather than treatment residuals.

Risks associated with uncontrolled lateral migration landfill gas in the subsurface are effectively mitigated by the installation of the gas venting system. The collection layer will channel the landfill gas to the passive vents where it will be released to the air.

Risks associated with future groundwater ingestion will be reduced as the cap will essentially eliminate infiltration through contaminated materials, thereby reducing contaminant mobility. This should lead to an eventual reduction in the level of contamination present in the groundwater. There is insufficient information, however, to quantify this risk reduction.

As in Alternative 2, the removal of the surface water from the northwest portion of the site eliminates residual risks associated with that contamination.

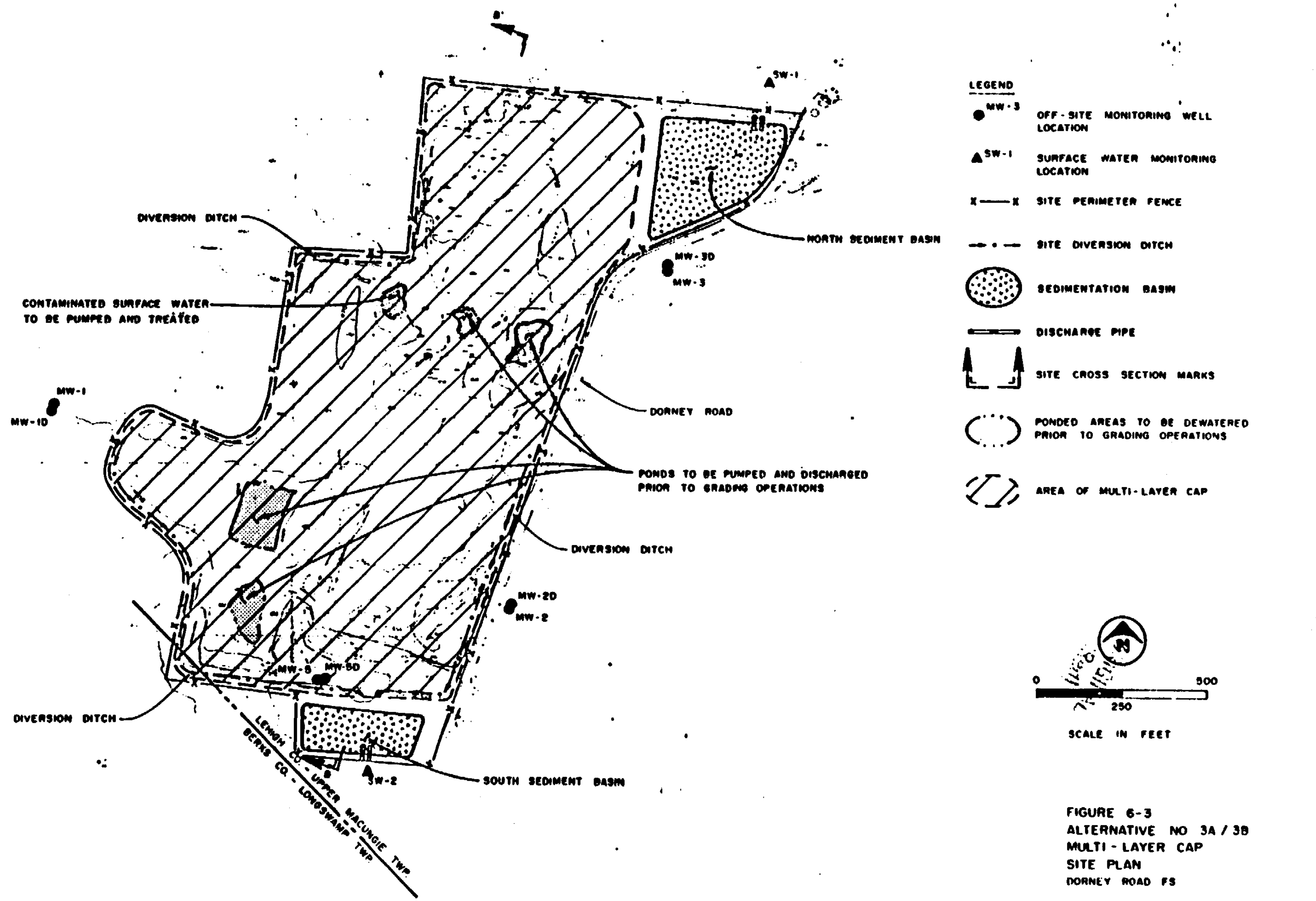


FIGURE 6-3
ALTERNATIVE NO 3A / 3B
MULTI - LAYER CAP
SITE PLAN
DORNEY ROAD FS

Adequacy of Controls: Either cap design should be highly effective in preventing direct contact with contaminated solids, and in reducing the volume of infiltration through contaminated materials, and the gas collection system should be equally effective in controlling lateral migration. The effectiveness of the fence and land use/deed restrictions were previously discussed. Draining of the standing water and its transport and treatment offsite is an effective method of mitigating risks associated with the surface water.

Long-term management activities would include semi-annual inspections and monitoring, and five year reviews, as previously described. Long-term monitoring requirements are the same as those previously discussed for Alternative No. 1. Operation and maintenance activities would include semi-annual visual inspection of the cap, vegetation control, periodic dredging of the sediment basin, the replacement of topsoil lost by erosion, and occasional reseeding of bare areas.

Reliability of Controls: The topsoil layer must be periodically repaired to replace topsoil lost by erosion, and reseeding activities must occasionally be performed. It is anticipated that, with proper maintenance of the uppermost layer, the synthetic layers of the cap should last indefinitely.

If the cap should somehow be breached, the risks associated with direct contact and incidental ingestion would be similar to those under the minimal no action alternative. A breach in the cap would also likely result in the leaching of contaminants to groundwater, possibly negating any risk reductions resulting from the successful implementation of the cap.

6.2.3.3 Reduction in Toxicity, Mobility and Volume

Installation of the cap should reduce contaminant mobility by effectively isolating contaminated surface materials from surface water runoff and by eliminating infiltration through contaminated zones. As the contaminated materials are not treated, there is no reduction in the toxicity or volume of the contaminants. The gas collection system is also an effective method for controlling the migration of landfill gas.

6.2.3.4 Implementability

Technical Feasibility: All components of Alternatives 3A and 3B utilize relatively common construction equipment and materials. Fence installation is a relatively simple construction item. Construction of the cap, while tedious because of the number of layers, is a well established procedure.

The reliability of site fencing, deed restrictions, and monitoring has been previously discussed. Either cap system should be very reliable in preventing contact with contaminated solids and in reducing infiltration into the waste. However, the RCRA-type cap offers increased reliability over the PA State cap since a secondary clay liner layer is employed. The passive methane venting system is reliable in preventing a buildup of and mitigation of uncontrolled migrating landfill gas.

ORIGINAL
(Red)

If additional remedial actions are deemed necessary at some time in the future, the cap should have little effect on such actions. The cap represents a simple physical barrier that could be easily removed as necessary using standard construction equipment.

All potential migration pathways will be effectively monitored by the proposed monitoring program.

Administrative Feasibility: Implementation of the institutional controls will require coordination with officials of Lehigh County. Long-term coordination between the USEPA and State of Pennsylvania will also be necessary. While the RCRA cap would meet PA State capping requirements, the PA cap may not be approved by USEPA since it does not include a secondary clay liner.

Availability of Services and Materials: All components of Alternative Nos. 3A and 3B utilize common construction items and procedures, and routine sampling procedures and analyses. All necessary equipment and materials are routinely available and have been demonstrated sufficiently for the purpose for which they are intended.

6.2.3.5 Cost

The total present worth of Alternative 3A is $15,000,000, and the total present worth of Alternative 3B is $14,000,000 (at 5% discount rate over 30 years). The total capital cost of Alternative 3A is $13,000,000 compared to $12,000,000 for Alternative 3B. O & M and periodic review costs are identical for Alternatives 3A and 3B. Tables 6-3 and 6-4 present detailed summaries of the costs for Alternatives 3A and 3B, respectively.

Capital Cost: Capital expenditures include mobilization of equipment to the site, surface water removal and disposal, site grading, construction of the cap and sediment basins, and fence erection.

O & M Cost: Ongoing annual maintenance is required for the perimeter fence, the sediment basins, and the vegetative layer of the cap. In addition, the topsoil layer would require replacement and revegetation every ten years due to erosion. This accounts for approximately $1,100,000 of the $1,800,000 total operation and maintenance cost. Monitoring requirements would be the same as for Alternative 2.

6.2.3.6 Compliance with ARARs

ARARs for Alternative No. 3A apply to construction of the fence and the construction of a RCRA cap, collection of contaminated water and its treatment offsite, and monitoring activities. Requirements for these activities include OSHA health and safety standards, and RCRA facility standards pertaining to construction of caps, preparedness and prevention, contingency plan and emergency procedures, manifesting and recordkeeping, groundwater protection, and closure and post-closure procedures.

TABLE 6-3
Cost Estimate Summary
Alternative No. 3A
RCRA Multi-Layer Cap

ORIGINAL
(Red)

Item	Capital Cost	Annual O & M	Present Worth 30 Years O&M/Replacement 3%	5%	10%
I. ACCESS RESTRICTIONS					
Site Fence	$86,000	$1,000	$20,000	$15,000	$9,000
Deed Restrictions	$1,000				
II. GENERAL SITE PREPARATION					
Equipment Staging Area	$30,000				
Equipment Mob/Demob	$150,000				
Drain Ponds	$1,000				
Treat Contaminated Surface Water	$1,000				
Clearing and Grubbing	$50,000				
Regrading	$710,000				
Runon/Runoff Controls	$160,000	$2,000	$39,000	$31,000	$19,000
III. MULTI-LAYER CAP					
Clay Liner	$1,700,000				
Synthetic Liner	$1,100,000				
Drainage System	$570,000				
Gas Discharge System	$600,000				
Vegetative Layer	$2,200,000	$1,000	$1,500,000	$1,100,000	$520,000 *
IV. MONITORING					
Runoff Monitoring		$12,000	$240,000	$180,000	$110,000
Groundwater Monitoring		$26,000	$510,000	$400,000	$250,000
Five Year Review			$55,000	$42,000	$23,000
CONSTRUCTION SUBTOTAL	$7,400,000		$2,400,000	$1,800,000	$930,000
Health and Safety (10%)	$740,000				
Bid Contigency (15%)	$1,100,000				
Scope Contingency (20%)	$1,500,000				
CONSTRUCTION TOTAL	$11,000,000				
Permitting & Legal (5%)	$550,000				
Services During Construction (8%)	$880,000				
TOTAL IMPLEMENTATION COST	$12,000,000				
Engineering & Design (10%)	$1,200,000				
TOTAL CAPITAL COSTS	$13,000,000				
PRESENT WORTH			$15,000,000	$15,000,000	$14,000,000

* Present worth calculated assuming replacement of one foot of topsoil and revegetation every 10 yrs.

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TABLE 6-4
Cost Estimate Summary
Alternative No. 3B
PA-Type Multi-Layer Cap

ORIGINAL (Red)

Item	Capital Cost	Annual O & M	Present Worth 30 Years O&M/Replacement 3%	5%	10%
I. ACCESS RESTRICTIONS					
Site Fence	$86,000	$1,000	$20,000	$15,000	$9,000
Deed Restrictions	$1,000				
II. GENERAL SITE PREPARATION					
Equipment Staging Area	$30,000				
Equipment Mob/Demob	$150,000				
Drain Ponds	$1,000				
Treat Contaminated Surface Water	$1,000				
Clearing and Grubbing	$50,000				
Regrading	$710,000				
Runon/Runoff Controls	$160,000	$2,000	$39,000	$31,000	$19,000
III. PA-TYPE MULTI-LAYER CAP					
Foundation Course	$660,000				
Synthetic Liner	$1,100,000				
Drainage System	$570,000				
Gas Discharge System	$600,000				
Vegetative Layer	$2,300,000	$1,000	$1,500,000	$1,100,000	$510,000 *
IV. MONITORING					
Runoff Monitoring		$12,000	$240,000	$180,000	$110,000
Groundwater Monitoring		$26,000	$510,000	$400,000	$250,000
Five Year Review			$55,000	$42,000	$23,000
CONSTRUCTION SUBTOTAL	$6,400,000		$2,400,000	$1,800,000	$920,000
Health and Safety (10%)	$640,000				
Bid Contigency (15%)	$960,000				
Scope Contingency (20%)	$1,300,000				
CONSTRUCTION TOTAL	$9,300,000				
Permitting & Legal (5%)	$470,000				
Services During Construction (8%)	$740,000				
TOTAL IMPLEMENTATION COST	$11,000,000				
Engineering & Design (10%)	$1,100,000				
TOTAL CAPITAL COSTS	$12,000,000				
PRESENT WORTH			$14,000,000	$14,000,000	$13,000,000

* Present worth calculated assuming replacement of one foot of the topsoil and revegetation every 10 yrs.

This alternative would not remove contaminated solids, nor would it provide total containment of contaminated soils with an impermeable liner beneath the contaminated soils. Alternative 3A would, however, provide for an impermeable cap providing containment of the contaminated soils meeting the requirements of 40 CFR 264.310(a) and a post-closure plan that protects human health and the environment. This alternative would meet all appropriate and relevant RCRA closure and post-closure requirements in 40 CFR 264.110-264.120. Alternative 3B would not meet RCRA cap construction requirements as interpreted in RCRA Guidance Document, Surface Impoundments, Liner Systems, and Freeboard Controls, July 1982. The potential for contaminants to migrate from the area and for human exposure to the contaminants would not be eliminated.

6.2.3.7 Overall Protection of Human Health and the Environment

The combined components of these alternatives will decrease the potential for direct contact with contaminated soil and subsurface wastes, and surface water. These alternatives will be protective of public health by mitigating the risk from dermal absorption or incidental ingestion of contaminated solids and surface water. Components of these alternatives that contribute to this reduction of risk from direct contact with soils include access/deed restrictions, site fence, and the installation of the multi-layer cap. The gas venting system mitigates hazards due to the lateral migration of landfill gas. Removal of contaminated surface water from the site eliminates the contact hazard associated with the water in the northwest portion of the site.

The deed restrictions would eliminate future potential exposure with contaminated soil by limiting future use or excavation of the site. Contaminated solids would be covered with a multi-layer cap, thereby eliminating risks of direct dermal contact or incidental ingestion.

The deed restrictions will also eliminate future potential exposure through ingestion of groundwater by prohibiting the use of groundwater directly under the site. Prohibiting the use of groundwater will also achieve the remedial action goals of eliminating the dermal absorption and inhalation of extracted groundwater contaminants from future wells installed on site. It does not, however, protect from future potential exposure to soluble contaminants that may first migrate downward, then laterally off site. These alternatives would complement any future groundwater remediation by reducing the volume of leachate being generated that may migrate to groundwater.

6.2.3.8 Community Acceptance

To be addressed after public comment period.

6.2.4 Alternative No. 4: On-Site RCRA Landfill

Alternative No. 4 involves the following major components:

- o Perimeter Fence
- o Deed Restrictions
- o Surface Water Elimination

- o Excavation of Waste
- o RCRA-Type Landfill
- o Multi-Layer Cap
- o Runoff Monitoring
- o Groundwater Monitoring

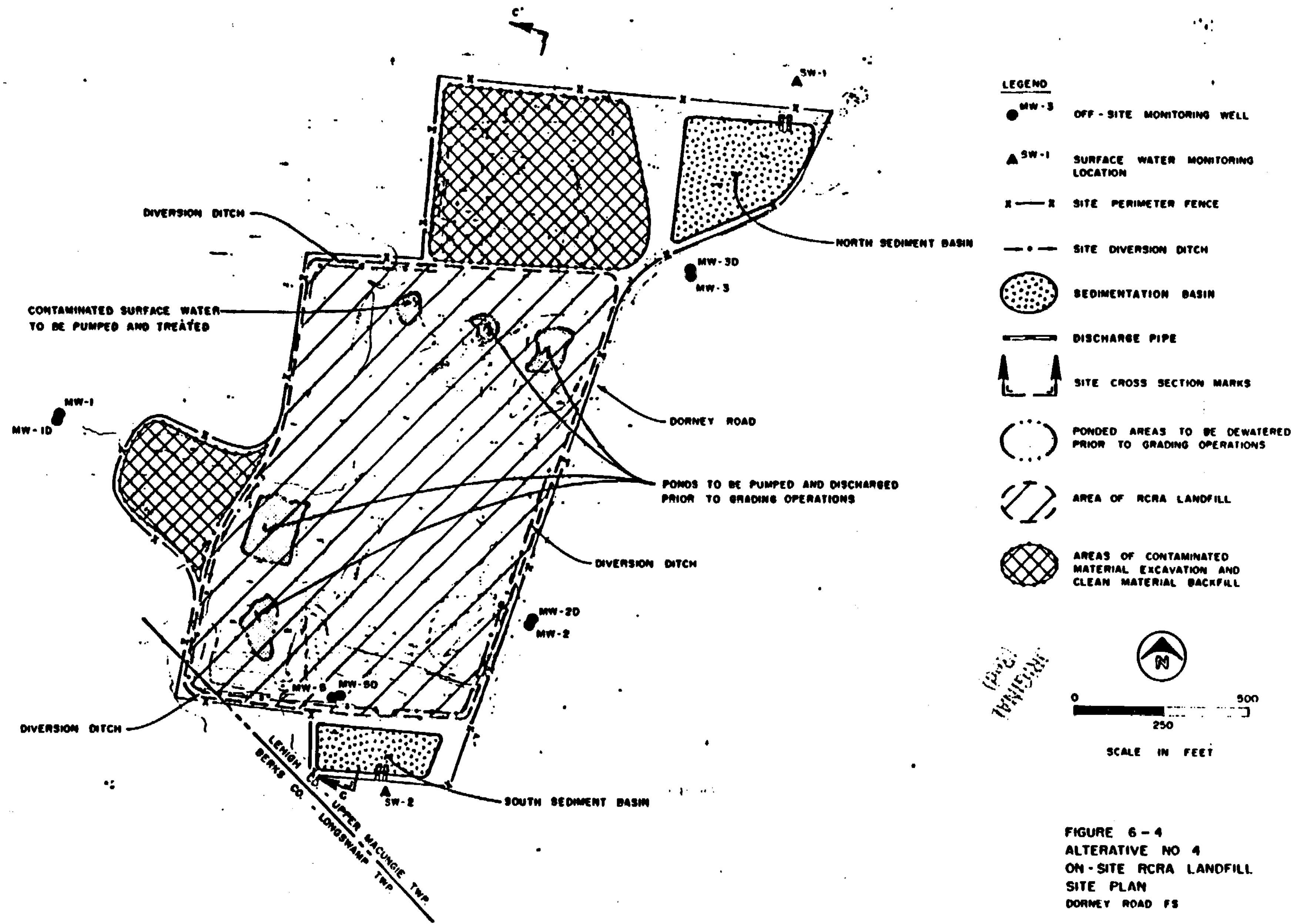
ORIGINAL (Red)

The entire contaminant source volume as defined in Section 5.2 would be excavated and placed in a lined landfill constructed on site. The landfill would cover about 20 acres in the center of the site and the western tongue and northern extension of the existing landfill would be backfilled with clean soil. Surface water elimination and site fence erection would also be performed as described for previous alternatives. A site plan showing implementation of Alternative 4 is presented in Figure 6-4. The landfill would be constructed in the same central areas being excavated; therefore, removal of the waste would be performed in a number of phases so that excavated material would not have to be temporarily stored off site. Excavated material would be stockpiled on site, while the liner system is constructed in the open pit, then placed within the liner system.

A RCRA-compliant landfill would consist of a continuous bottom liner system and a RCRA-type multi-layer cap. The cap would be the same as that discussed under Alternative No. 3A but covering only 20 acres instead of 34, and the bottom liner would consist of the following: 2-ft. compacted clay layer, two synthetic liners, leachate collection system, and leak detection system. The leachate collection system functions to collect and remove leachate from the waste material placed in the landfill. Leachate would be pumped from the system and hauled to a public or private treatment facility for disposal. The leak detection layer is designed to rapidly convey any leachate which may leak through the primary liner to a sump, thus providing quick detection of liner failure. A secondary liner system consisting of a synthetic membrane and a compacted clay layer provides additional containment in the event of primary liner failure.

6.2.4.1 Short-Term Effectiveness

There are no residents living within 1,000 ft. of the site. Therefore, implementation of this alternative should not expose any local population to increased potential risk. Occasional travelers on Dorney Road and farmers working in adjacent fields may be exposed to increased risk at times when the most highly contaminated wastes are being excavated and stockpiled. Emission control measures accompanied by warning systems will need to be implemented. Implementation of this alternative may result in a short-term adverse environmental impact by the disruption of a migratory waterfowl resting area. Migratory waterfowl and other wildlife currently residing near the site should be able to relocate easily since the surrounding areas provide sufficient similar habitat.



ORIGINAL (Red)

FIGURE 6 – 4
ALTERATIVE NO 4
ON-SITE RCRA LANDFILL
SITE PLAN
DORNEY ROAD FS

Risks to workers will occur due to contaminant volatilization at waste excavations and at the landfill. Workers involved with the waste excavation and landfilling activities will also be exposed to the additional risks associated with dermal contact with contaminated solids. Risks will be mitigated by properly outfitting workers with appropriate personal protection equipment, including proper breathing apparatus, continuous air monitoring, and the use of controlled excavations.

It is estimated that design of Alternative No. 4 and contractor procurement would be completed in approximately 1 year after the signing of the ROD. Implementation would take approximately 5 years.

6.2.4.2 Long-Term Effectiveness and Permanence

Implementation of the containment technologies in Alternative No. 4 could serve to mitigate a number of risks identified in the PHE. As with the soil cover and cap alternatives, the risk to teenager and adult hunters from dermal contact with contaminated soils waste and surface water would essentially be eliminated. The risk due to groundwater ingestion would be reduced since the source of contaminants in the groundwater would be effectively contained.

The contaminants are not being treated; therefore, a failure or breach of the cap or liner system would result in the reoccurrence of health risks for dermal contact and incidental ingestion. These risks have the potential of being greater than current risks since waste will be concentrated in use large reservoir and a leak could result in a release of higher contamination levels.

Risk associated with migration of landfill gas are effectively mitigated by the installation of the gas venting system. The collection layer will channel the landfill gas to the passive vents when it will be released to the air.

Adequacy of Controls: The adequacy of the RCRA cap and gas collection and treatment system were previously discussed for Alternative Nos. 3A and 3B. The RCRA landfill liner should, in all probability, achieve its overall performance requirement ($K<10^{-7}$ cm/sec.), thereby effectively minimizing the volume of leachate flowing to the groundwater system.

Long-term management activities are the same as for Alternative Nos. 3A and 3B, and include semi-annual inspections, long-term monitoring, and five year reviews. Long-term monitoring requirements are also the same as for Alternative Nos. 3A and 3B. Operation and maintenance functions are similar to those previously discussed for Alternative No. 2. One additional function to be performed is the routine removal of fluid from the leachate collection zone on an as-necessary basis.

Reliability of Controls: The reliability of the RCRA cap, institutional restrictions, and fencing have been previously discussed. As with the cap, it is anticipated that the onsite landfill could function properly for an indefinite period, assuming proper maintenance of the cap and leachate collection systems are performed.

If the cap would be breached, the direct contact and VOC inhalation risks would return to those for a no-action alternative. If the liner would develop a leak, the leaching of contaminants to the ground water would increase the risks associated with groundwater consumption. It is not possible, however, to quantify such a risk.

6.2.4.3 Reduction in Toxicity, Mobility and Volume

The most significant reduction in contaminant mobility is achieved by encapsulation of the material within the RCRA landfill. As the materials are not treated, neither contaminant volume nor toxicity are reduced. Encapsulation of the wastes within the RCRA landfill will greatly reduce the mobility of the contaminants by eliminating infiltration through uncontained wastes.

Alternative No. 4 provides a greater reduction in contaminant mobility, qualitatively and quantitatively, than does Alternative Nos. 3A and 3B. It is not possible, however, to quantify the reduction.

6.2.4.4 Implementability

Technical Feasibility: All components of Alternative No. 4 utilize relatively common construction equipment and materials. Fence installation is a simple construction item. Waste excavation, while not a very common item, utilizes routine construction procedures. Construction of the RCRA liner and cap, while tedious because of the staging requirements and the number of layers, is an established procedure.

The reliability of site fencing, deed restrictions, and monitoring have been previously discussed. The RCRA landfill should be very reliable in preventing contact with contaminated solids and in reducing contaminant migration to groundwater.

If additional remedial actions are deemed necessary, the RCRA landfill should positively affect such an action. This would be the result of containing all known contaminated solids in one location at the site.

All potential migration pathways should be effectively monitored by the proposed monitoring program.

Administrative Feasibility: Implementation of the institutional controls will require coordination with officials of Lehigh County and local townships. Long-term coordination between USEPA and the State of Pennsylvania will also be necessary.

Availability of Services and Materials: All components of Alternative No. 4 utilize common construction items and procedures, and routine sampling procedures and analysis. All necessary equipment and materials are routinely available and have been documented sufficiently for the purpose for which they are intended.

6.2.4.5 Cost

The total present worth cost for Alternative 4 assuming 5% discount rate is $46,000,000. Table 6-5 provides a summary of the capital, O & M, and five year review costs. Five year review is required with this alternative since contaminants remain onsite.

Capital Cost: Capital costs include mobilization of heavy equipment to the site, fence erection, surface water removal and disposal, and construction of the sediment basins and multi-layer cap and bottom liner. Construction of the landfill liner and cap account for over 60% of the $10,000,000 total direct capital cost.

O & M Cost: This alternative has the same O & M requirements as Alternatives 3A/3B with the addition of leachate collection and treatment from the landfill. Also included with the O & M expenditures are the costs for excavation of waste and backfilling, calculated as present worths over the five year construction period. These are calculated as present worth costs since they are labor intensive and will be distributed over a significant period of time.

Five-Year Review: These costs are the same as all previous alternatives.

6.2.4.6 Compliance with ARARs

ARARs for this alternative apply to construction of an onsite RCRA landfill and leachate collection system, excavation of contaminated soils and municipal waste, the reclamation of the areas of excavation, collection and offsite treatment of contaminated surface water, and monitoring activities. Requirements for these activities include OSHA health and safety standards and RCRA facility standards pertaining to construction of landfills and caps, preparedness and prevention, contingency plan and emergency procedures, manifesting and recordkeeping, groundwater protection, closure and post-closure procedures, and proposed standards for the control of emissions of volatile organics.

The onsite landfill would be designed, installed and constructed in accordance with 40 CFR 264, Subpart N, and monitored according to RCRA regulations and guidelines, 40 CFR 264.300-264.310. Prior to disposal in the onsite landfill, contaminated soils and municipal wastes would be dewatered to eliminate any free liquids. Treatment of the contaminated soils and municipal waste in this manner would effectively immobilize the contaminant constituents and satisfy closure and post-closure requirements, 40 CFR 264.110-264.120.

Treatment of contaminated surface water would reduce contaminant levels below surface water criteria (for protection of aquatic life). It is anticipated that contaminant levels in groundwater would decrease over time to levels below groundwater quality criteria.

TABLE 6-5
Cost Estimate Summary
Alternative No. 4
Onsite RCRA Landfill

Item	Capital Cost	Annual O & M	Present Worth 30 Years O&M/Replacement 3%	5%	10%
I. ACCESS RESTRICTIONS					
Site Fence	$86,000	$1,000	$20,000	$15,000	$9,000
Deed Restrictions	$1,000				
II. GENERAL SITE PREPARATION					
Equipment Staging Area	$30,000				
Equipment Mob/Demob	$200,000				
Drain Ponds	$1,000				
Treat Contaminated Surface Water	$1,000				
Clearing and Grubbing	$50,000				
Runon/Runoff Controls	$160,000	$2,000	$39,000	$31,000	$19,000
Waste Storage Building	$98,000				
III. EXCAVATION/WASTE HANDLING					
Excavate and Stockpile Waste		$3,100,000	$14,000,000	$13,000,000	$12,000,000 *
Regrade Waste Pit		$270,000	$1,200,000	$1,200,000	$1,000,000 *
Backfill and Compact Waste		$2,400,000	$11,000,000	$10,000,000	$9,100,000 *
Clean Backfill of "Tongue" Areas	$3,000,000				
IV. RCRA BOTTOM LINER SYSTEM					
Clay Liner	$970,000				
Synthetic Liners (2)	$1,200,000				
Leachate Collection System	$320,000	$75,000	$1,500,000	$1,200,000	$710,000
Leak Detection System	$250,000				
Protective Sand Layer	$370,000				
V. MULTI-LAYER CAP					
Clay Liner	$970,000				
Synthetic Liner	$660,000				
Drainage System	$320,000				
Gas Discharge System	$340,000				
Vegetative Layer	$1,200,000	$1,000	$840,000	$600,000	$290,000 **
VI. MONITORING					
Runoff Monitoring		$12,000	$240,000	$180,000	$110,000
Groundwater Monitoring		$26,000	$510,000	$400,000	$250,000
Five Year Review			$55,000	$42,000	$23,000
CONSTRUCTION SUBTOTAL	$10,000,000		$29,000,000	$27,000,000	$24,000,000
Health and Safety (10%)	$1,000,000				
Bid Contigency (15%)	$1,500,000				
Scope Contingency (20%)	$2,000,000				
CONSTRUCTION TOTAL	$15,000,000				
Permitting & Legal (5%)	$750,000				
Services During Construction (8%)	$1,200,000				
TOTAL IMPLEMENTATION COST	$17,000,000				
Engineering & Design (10%)	$1,700,000				
TOTAL CAPITAL COSTS	$19,000,000				
PRESENT WORTH			$48,000,000	$46,000,000	$43,000,000

* Operation costs calculated over 5 yr. construction period.
** Present worth calculated assuming replacement of the topsoil layer and revegetation every 10 yrs.

6.2.4.7 Overall Protection of Human Health and the Environment

The combined components of this alternative will decrease the potential for direct contact with contaminated soil and subsurface wastes and eliminate contact with contaminated surface water. This alternative will be protective of public health by mitigating the risk from dermal absorption or incidental ingestion of contaminated solids and surface water. Components of this alternative that contribute to this reduction of risk from direct contact with soils include access/deed restriction and the encapsulation in the onsite landfill.

The deed restrictions would eliminate future potential exposure with contaminated soil by limiting future use or excavation of the landfill. Contaminated soil would be covered with a multi-layer cap, thereby eliminating risks of direct dermal contact or incidental ingestion.

The deed restrictions will also eliminate future potential exposure through ingestion of groundwater by prohibiting the use of groundwater directly under the site. Prohibiting use of groundwater will also achieve the remedial action goals of eliminating the dermal absorption and inhalation of extracted groundwater contaminants from future wells installed on site.

This alternative is more protective of groundwater than Alternative Nos. 2 and 3A/3B. This additional protectiveness is achieved by the encapsulation of the wastes in an onsite landfill.

6.2.4.8 Community Acceptance

To be addressed after public comment period.

6.2.5 Alternative No. 5: On-Site Incineration

Implementation of this alternative would provide complete destruction of organic contaminants and subsequent containment of the residuals which contain: remaining inorganic contaminants. The result would be maximum protection of both human health and the environment from risks posed by the contaminated solid media. The components included in this alternative are shown on Figure 6-5 and listed below:

- Perimeter Fence
- Deed Restrictions
- Surface Water Elimination
- Excavation of waste
- Incineration
- RCRA-Type Landfill
- Multi-Layer Cap
- Runoff Monitoring
- Groundwater Monitoring

The only significant difference between this alternative and Alternative No. 4 is that contaminated solids would be incinerated prior to placement in the RCRA-type landfill. Containment of the ash would be necessary since inorganic contaminants would not be destroyed through incineration.

6.2.5.1 Short-Term Effectiveness

The short-term risks to occasional travelers on Dorney Road and farmers working in adjacent fields are the same as Alternative No. 4. The environmental impacts on the migratory waterfowl resting area are also the same.

Onsite incineration may result in short-term low level emissions of organics as well as products of incomplete combustion. In addition, incineration will not thermally destroy inorganics. Since there will be an air pollution control system on the incinerator to decrease emissions of particulate matter to permitted levels and inorganics are predominantly adsorbed to particulate matter, emissions of inorganics (some of which are probable human carcinogens by inhalation) would not be excessive.

Risks to workers will occur due to contaminant volatilization at waste excavations, and at the processing and stockpile areas. Workers involved with the waste excavation and processing activities will also be exposed to the additional risks associated with dermal contact with contaminated solids. Low level emissions of organic and inorganic contaminants from the incinerator emission may also occur, although the risks should be insignificant. Risks will be mitigated by properly outfitting workers with appropriate personal protection equipment, including respiratory protecting devices. It is anticipated that the design and contractor procurement would require approximately 2 years after signing of the ROD. Implementation of the RA would take approximately 12 years.

6.2.5.2 Long-Term Effectiveness and Permanence

Magnitude of Residual Risks: Implementation of the treatment and containment technologies in Alternative No. 5 will mitigate a number of the risks identified in the PHE. The risks mitigated are essentially the same as those addressed in Alternative No. 4. In addition, encapsulation of the treatment residue in a RCRA landfill effectively isolates inorganics concentrated by the thermal treatment process from potential receptors, and also greatly reduces contaminant mobility. These mechanisms would reduce the overall risk to below the 10^{-6} level.

Risks associated with future ground water use should be reduced significantly. This would be a direct result of destroying the organic contaminants and encapsulating the treatment residue in the onsite landfill, greatly reducing the volume of contaminants leaching to ground water. As previously discussed, insufficient information is available to characterize the reduction in risk.

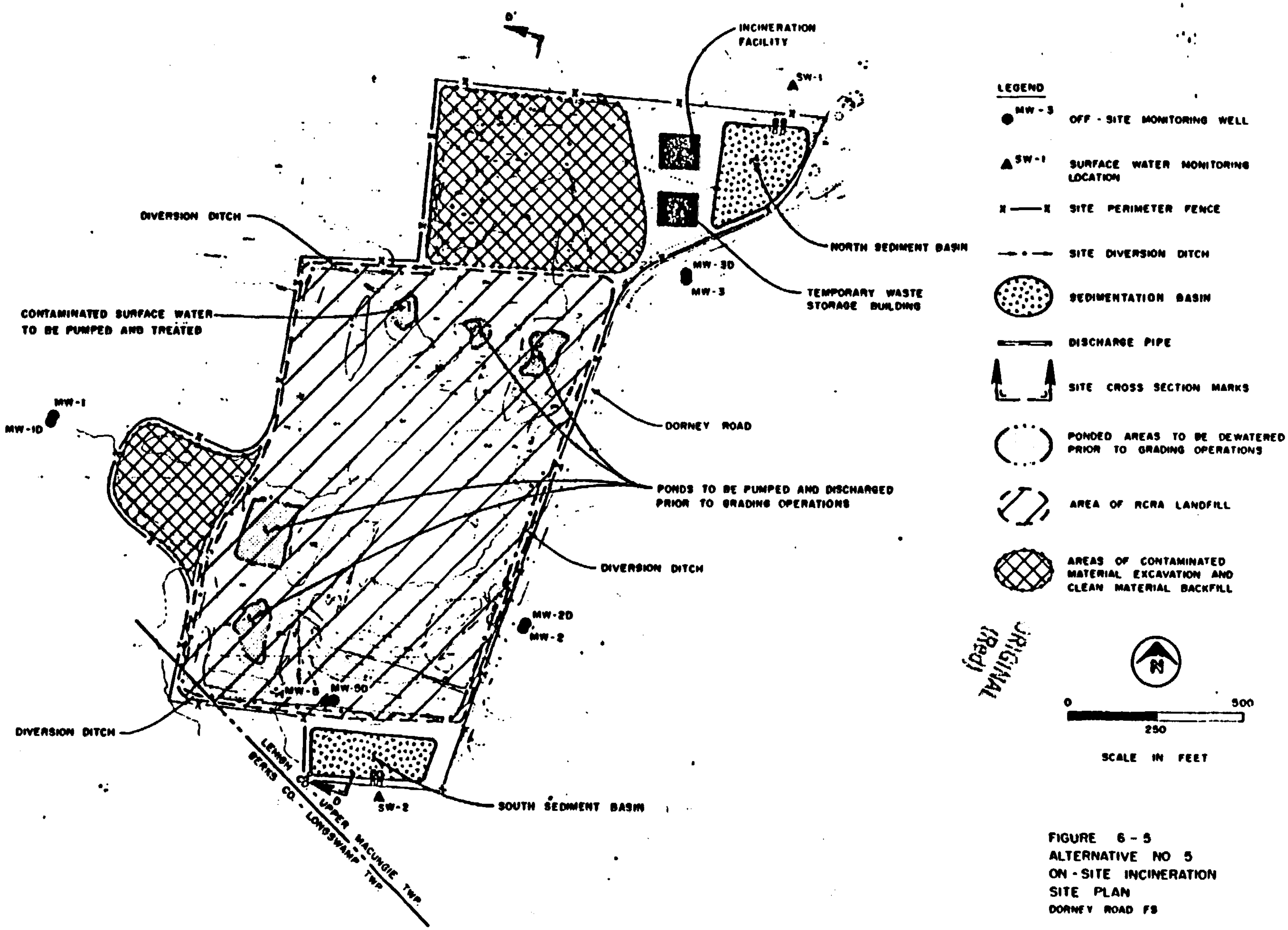


FIGURE 6 - 5
ALTERNATIVE NO 5
ON-SITE INCINERATION
SITE PLAN
DORNEY ROAD FS

Adequacy of Controls: All facets of this alternative have been discussed previously for Alternative No. 4, with the exception of the thermal treatment system. Thermal treatment units have demonstrated high destruction and removal efficiencies (DRE), in excess of 99.99% for most organic contaminants, and in excess of 99.9999% for PCBs, as required by RCRA and TSCA regulations. Therefore, it is highly probable that the thermal treatment unit will be capable of providing the required process efficiency.

Long-term management requirements are identical to those for Alternative No. 4, assuming that the onsite landfill is required for the treatment residue. In the event that the treatment residue could be delisted, long-term management, with the exception of a comprehensive monitoring program to verify alternative effectiveness, would probably not be necessary.

Assuming construction of the landfill, operation and maintenance functions would be similar to those for Alternative No. 4, with one exception. As all organics would be thermally destroyed prior to landfilling, the gas collection and venting layer would not be necessary and therefore the associated operational costs could be eliminated.

Reliability of Controls: The reliability of the physical and institutional controls that comprise this alternative have been discussed previously.

If the RCRA cap or landfill liner would fail, the health risks that would occur would be less than those should a similar situation occur after the implementation of Alternative No. 4. This is due to the elimination of potential risks caused by organic contaminants by their thermal destruction prior to landfilling.

6.2.5.3 Reduction in Toxicity, Mobility, and Volume

The thermal treatment of the contaminated materials provides the multiple benefit of reducing the toxicity and volume of organic contaminants. This is accomplished by thermal destruction of the organic contaminants, thereby reducing their volume and eliminating them as toxics of concern in the treatment residue.

The potential risks associated with the incinerator ash would be mitigated by its encapsulation within the onsite RCRA landfill. This will reduce the mobility of these contaminants.

6.2.5.4 Implementation

Technical Feasibility: All components of Alternative No 5, except for the thermal treatment unit and related items, have been previously discussed. They were found to be common, easy to implement, reliable technologies.

Incineration is a proven technology for the destruction of organic contaminants in the onsite soils and subsurface wastes. In order to achieve compliance with applicable Federal and State ARARs, the incinerator is required to have a high organic destruction efficiency (99.99% under RCRA, 99.9999% under TSCA), making it an extremely reliable technology.

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To obtain information on handling conditions at a specific site, potential bidders would need detailed information on amounts and types of waste at the site.

If future remedial actions are deemed necessary, the thermal treatment and onsite landfilling of the contaminated solids should serve to facilitate any such action. This would be due to the consolidation and encapsulation in one location of the contaminated materials, and the removal of the organics prior to landfilling.

The effectiveness of the units in destroying organic contaminants in soils should be verified by test burns prior to full-scale implementation on site. This should also include TCLP analyses on the treatment residues to determine if they could be delisted.

All potential migration pathways should be effectively monitored by the proposed monitoring program.

Administrative Feasibility: Implementation of the institutional controls will require coordination with officials of Lehigh County. Long-term coordination between USEPA and the State of Pennsylvania will also be necessary.

Availability of Services and Materials: All components of Alternative No. 5, with the exception of the thermal treatment unit, utilize common construction items and procedures, and routine sampling procedures and analyses. Most of the necessary equipment and materials are routinely available and have been demonstrated sufficiently for the purpose for which they are intended. Thermal treatment units are currently available for purchase or leasing. A number of remedial action contractors also have access to mobile treatment units.

6.2.5.5 Cost

The total present worth of this alternative is $670,000,000, approximately 15 times greater than that for landfilling without treatment (Alternative 4). Table 6-6 provides a summary of capital, O & M and periodic review costs. As in Alternative 4, costs for ongoing processes during the treatment period, such as excavation and incineration, are calculated as present worths based on an annual production.

Capital Costs: Total direct capital cost is about $15,000,000 and total capital cost including indirect expenditures is about $28,000,000. The components of this capital cost are the same as those for Alternative 4 with the addition of approximately $4,700,000 for incinerator mobilization and setup.

TABLE 6-6
Cost Estimate Summary
Alternative No. 5
Onsite Incineration

Item	Capital Cost	Annual O & M	Present Worth 30 Years O&M/Replacement 3%	5%	10%
I. ACCESS RESTRICTIONS					
Site Fence	$86,000	$1,000	$20,000	$15,000	$9,000
Deed Restrictions	$1,000				
II. GENERAL SITE PREPARATION					
Equipment Staging Area	$30,000				
Equipment Mob/Demob	$200,000				
Drain Ponds	$1,000				
Treat Contaminated Surface Water	$1,000				
Clearing and Grubbing	$50,000				
Runon/Runoff Controls	$160,000	$2,000	$39,000	$31,000	$19,000
Waste Storage Building	$98,000				
III. EXCAVATION/WASTE HANDLING					
Excavate and Stockpile Waste		$1,300,000	$13,000,000	$12,000,000	$8,900,000 *
Load Incinerator		$310,000	$3,100,000	$2,700,000	$2,100,000 *
Regrade Waste Pit		$110,000	$1,100,000	$1,000,000	$750,000 *
Backfill and Compact Ash		$310,000	$3,100,000	$2,700,000	$2,100,000 *
Clean Backfill of "Tongue" Areas	$3,000,000				
IV. INCINERATION					
Mob/Demob of Incineration Units	$4,000,000				
Utility Installation	$200,000				
Pilot Burns and Permitting	$500,000				
Mechanical Processing		$6,100,000	$61,000,000	$54,000,000	$42,000,000
Operation		$64,000,000	$640,000,000	$570,000,000	$440,000,000 *
V. RCRA BOTTOM LINER SYSTEM					
Clay Liner	$970,000				
Synthetic Liners (2)	$1,200,000				
Leachate Collection System	$320,000	$75,000	$1,500,000	$1,200,000	$710,000
Leak Detection System	$250,000				
Protective Sand Layer	$370,000				
VI. MULTI-LAYER CAP					
Clay Liner	$970,000				
Synthetic Liner	$660,000				
Drainage System	$320,000				
Vegetative Layer	$1,200,000	$1,000	$840,000	$600,000	$290,000 **
VII. MONITORING					
Runoff Monitoring		$12,000	$240,000	$180,000	$110,000
Groundwater Monitoring		$26,000	$510,000	$400,000	$250,000
Five Year Review			$55,000	$42,000	$23,000
CONSTRUCTION SUBTOTAL	$15,000,000		$720,000,000	$640,000,000	$500,000,000
Health and Safety (10%)	$1,500,000				
Bid Contigency (15%)	$2,300,000				
Scope Contingency (20%)	$3,000,000				
CONSTRUCTION TOTAL	$22,000,000				
Permitting & Legal (5%)	$1,100,000				
Services During Construction (8%)	$1,800,000				
TOTAL IMPLEMENTATION COST	$25,000,000				
Engineering & Design (10%)	$2,500,000				
TOTAL CAPITAL COSTS	$28,000,000				
PRESENT WORTH			$750,000,000	$670,000,000	$530,000,000

* Operation costs calculated over 12 yr. incineration period.
** Present worth calculated assuming replacement of the topsoil layer and revegetation every 10 yrs.

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(Red)

O & M Costs: Operation and maintenance costs approximately $640,000,000 of which $570,000,000 is due to incinerator operation over the 12 year treatment duration. Costs for excavation, handling, and backfill of waste are also calculated as present worth over a 12 year period.

Five-Year Review: Review costs have been previously discussed.

6.2.5.6 Compliance with ARARs

ARARs for this alternative apply to the construction of a RCRA approved onsite landfill and leachate collection system, excavation of contaminated soils and municipal waste, incineration of the contaminated soils and municipal waste, the reclamation of the areas of excavation, collection and offsite treatment of contaminated surface water, and monitoring activities. Requirements for these activities include OSHA health and safety standards, and RCRA facility standards pertaining to construction of landfills and caps, construction and operation of incinerators, preparedness and prevention, contingency plan and emergency procedures, manifesting and recordkeeping, ground water protection, closure and post-closure procedures, and proposed standards for the control of emissions of volatile organics.

This containment alternative would consolidate contaminated soils and municipal wastes and eliminate all organics and PCBs by incineration prior to the placement of the waste materials in a RCRA approved landfill. The onsite landfill would be designed, installed, and constructed in accordance with 40 CFR 264, Subpart N, and monitored according to RCRA regulations and guidelines, 40 CFR 264.300-264.310. Prior to disposal in the landfill, contaminated soils and municipal wastes would be incinerated in an onsite incinerator operated in accordance with RCRA regulations and guidelines, 40 CFR 264, Subpart O. Treatment of the contaminated soils and municipal waste by incineration and encapsulation in the landfill would effectively destroy the organic contaminant constituents and satisfy closure and post-closure requirements, 40 CFR 264.110-264.120. The proposed standards for the control of emissions of volatile organics, 52 FR 3748, would be met by the use of an off-gas collection and treatment unit as an integral part of the incinerator. The requirements of the Clean Air Act (CAA) - National Air Quality Standards (NAQS), as in 440 CFR 1 to 99, do not specifically regulate hazardous waste incinerator emissions, but it is likely that Prevention of Significant Deterioration (PSD) provisions would apply to the treatment system. No gas vent and collection system would be required for the landfill as the VOC contaminants would have been eliminated during the incineration process.

It is anticipated that contaminant levels in surface and ground water would decrease over time to levels below surface water criteria (for protection of aquatic life) and ground water quality criteria.

6.2.5.7 Overall Protection of Human Health and the Environment

The combined components of this alternative will significantly decrease the risks associated with direct contact with, and incidental ingestion of, contaminated soil and subsurface wastes and contaminated surface water. This alternative will be protective of public health by mitigating the risk from dermal absorption or incidental ingestion of contaminated soils. Components of this alternative that contribute to this reduction of risk from direct contact with solids include access/deed restriction, thermal treatment to destroy organic contaminants, and the encapsulation of treatment residues in the onsite landfill. Surface water hazards are eliminated by the removal of contaminated surface water from the site.

The thermal treatment of the contaminated solids results in the elimination of a long-term source of ground water contamination, and eliminates the direct contact risk associated with these materials. It also eliminates the potential risk due to inhalation of VOCs in the landfill gas by destroying the source of the VOCs.

The deed restrictions could reduce future potential exposure with contaminated soil by limiting future use or excavation of the landfill. The treatment residue would be covered with a multi-layer cap, thereby eliminating risks of direct dermal contact or incidental ingestion.

The deed restrictions will also reduce future potential exposure through ingestion of ground water by prohibiting the use of ground water directly under the site. Prohibiting use of ground water will also achieve the remedial action goals of eliminating the dermal absorption and inhalation of extracted ground water contaminants from future wells installed on site.

This alternative is more protective of ground water than Alternative No. 4. This additional protectiveness is achieved by the destruction of organic contaminants and the encapsulation of the treatment residue in an onsite landfill.

Overall, this alternative is probably more protective of human health and the environment than is Alternative 4 due to the thermal destruction of organic contaminants prior to landfilling.

6.2.5.8 Community Acceptance

Will be addressed after the public comment period.

6.3 SUMMARY OF DETAILED ANALYSIS

In this section, the evaluation of each alternative is summarized and compared to the other alternatives. A comparative analysis is provided for each of the eight applicable evaluation criteria identified in Section 6.1.

6.3.1 Short-Term Effectiveness

Potential risks to the local population should not increase during implementation of any of the remedial alternatives since there are no residents living within 1,000 ft. of the site. Excavation of the contaminated waste during construction of Alternatives 4 and 5 would, however, pose low exposure risks due to inhalation of organic vapors or fugitive dust for travelers on Dorney Road. Migratory waterfowl and other wildlife currently residing near the site would be temporarily displaced during construction of all alternatives, except Alternative 1.

Workers responsible for implementing the remedial actions may be exposed to risks associated with dermal contract, incidental ingestion, and inhalation of organic vapors or fugitive dust during construction. These risks would be extremely low for implementation of Alternative 1 since work would be performed at the site perimeter and the construction period would be brief (less than one month). Implementation of Alternatives 2 and 3A/3B could pose low to moderate risks to workers since the contaminated surface soils and waste would be disturbed during regrading. The duration of the construction period for Alternatives 2 and 3A/3B would, however, be less than one year. Implementation of Alternatives 4 and 5 would present moderate risks to workers due to the extensive excavation and handling of contaminated waste required and the relatively long construction period (approximately 5 years for Alternative 4 and 12 years for Alternative 5).

6.3.2 Long-Term Effectiveness

Alternative 1 would provide minimal reduction of the identified, existing risks by limiting access of hunters and other site trespassers and deterring future use of the site. Monitoring of surface and groundwater would indicate the need for subsequent action. The reliability of the site fence is relatively high, but is dependent upon continued inspection and maintenance, while enforcement of deed restrictions would be difficult to ensure. Monitoring technologies are well developed and reliable, but only indicate the presence of a problem rather than performing a protective function.

Alternatives 2, 3A and 3B should be equally effective in reducing the risks of dermal contact and incidental ingestion of contaminated soil, solid waste, and surface water. Alternative 2 would not be protective of groundwater, while Alternatives 3A and 3B would reduce infiltration and the associated leaching of solid waste contaminants to the water table. The reliability of the soil cover in Alternative 2 is considerably less than that afforded by the multi-layer caps of Alternatives 3A and 3B. Of the RCRA and PA-type caps, the RCRA cap offers slightly greater reliability since a clay liner layer is employed, in addition to the synthetic liner. The potential for future risk would still exist with implementation of Alternatives 2, 3A or 3B since contaminants would be left on site.

Alternatives 4 and 5 would provide maximum protectiveness as they eliminate both exposure risks and leaching of contaminants to groundwater. Properly constructed, a lined landfill should be very reliable; however, the reliability is dependent upon continued maintenance and monitoring. In Alternative 4, contaminants remain on site indefinitely; therefore, there would be a potential for future risks should the landfill liner fail. All organic contaminants would be destroyed in Alternative 5, thus minimizing the potential for future risks from organics in the event of liner failure.

6.3.3 Reduction of Toxicity, Mobility, and Volume (TMV)

The TMV of site contaminants would be unaffected by implementation of Alternative 1. Alternatives 2, 3A and 3B would provide little to moderate reduction of contaminant mobility. These alternatives would reduce the mobility of surface contaminants, while Alternatives 3A and 3B would also reduce the mobility subsurface contaminants leaching to groundwater. Contaminants would be completely immobilized in Alternative 4, but toxicity and volume would be unaffected. Implementation of Alternative 5 would result in the most complete reduction of TMV as incineration would destroy all organic contaminants, while residual inorganic contaminants would be immobilized within a lined landfill.

6.3.4 Implementability

Implementation of Alternative 1 would be extremely simple, requiring only the construction of a fence around the site and periodic monitoring of existing wells and surface water. Implementation of Alternative 2 should also prove relatively easy as the civil construction techniques required are well developed and commonly used. Alternatives 3A and 3B would be somewhat more difficult to implement due to the complex construction of the multi-layer cap. Multi-layer cap construction, however, is well developed and should not pose a major problem with adequate engineering design. Implementation of Alternatives 4 and 5 would be extremely difficult due to the volume of contaminated waste to be handled and the necessity for staged construction with simultaneous excavation and liner construction. Operation and coordination of the incinerator with excavation and backfilling of the waste would increase the complexity of the engineering design and site work for Alternative 5. Implementation of Alternatives 4 and 5 would not be impossible, but would require complex design and construction techniques.

6.3.5 Cost

The total capital and total present worth costs for all alternatives are summarized and presented in Table 6-7.

6.3.6 Compliance with ARARs

All alternatives would be designed to meet action specific ARARs, with the exception of Alternative 3B which would not comply with RCRA design requirements for cap construction. No location-specific ARARs were found to

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TABLE 6-7
SUMMARY OF TOTAL COSTS FOR ALL ALTERNATIVES
DORNEY ROAD FS

Alternative No.	Description	Total Capital Cost	Total Present Worth Cost*
1	Minimal/No Action	$ 120,000	$ 760,000
2	Soil Cover	$ 5,300,000	$ 6,900,000
3A	RCRA Multi-Layer Cap	$13,000,000	$ 15,000,000
3B	PA-Type Multi-Layer Cap	$12,000,000	$ 14,000,000
4	Onsite RCRA Landfill	$19,000,000	$ 46,000,000
5	Onsite Incineration	$28,000,000	$670,000,000

*Present worth calculated over 30 year period at 5% interest rate.

be applicable for any of the remedial actions considered. Chemical-specific ARARs were considered as they apply to surface water quality and air quality. For Alternatives 2, 3A, 3B, 4 and 5, surface water discharged to local drainage, as well as the treated contaminated surface water, would meet Pennsylvania Water Quality Standards and Federal Ambient Water Quality Criteria. Contaminated surface water remaining on site in Alternative 1 would not meet water quality standards. Controls would be implemented during excavation in Alternatives 2, 3A, 3B, 4 and 5 to reduce particulate and contaminant vapor concentrations in air to acceptable levels under State and Federal air quality regulations. Incinerator emissions would also meet State and Federal air quality requirements.

6.3.7 Overall Protection of Human Health and the Environment

The alternatives evaluated offer a wide range of overall protectiveness from almost no protection of human health or the environment to maximization of protection. Alternative 1 would provide minimal protection of human health by restricting access to the site and no protection of the environment. The current site-related risks identified in the PHE would be unmitigated. Alternative 2 would greatly reduce the risks of incidental ingestion and dermal absorption of contaminated surface water and solid waste by placing a clean soil cover over the site. The leaching of solid waste contaminants to groundwater would not be significantly reduced by implementation of this alternative. Alternatives 3A and 3B would offer the same protection of human health as Alternative 2, but with the increased reliability of a multi-layer cap. In addition, Alternatives 3A and 3B would prevent infiltration of precipitation into the waste, thus reducing the leaching of contaminants to groundwater. Implementation of Alternatives 1, 2, 3A and 3B would pose minimal short-term risks during construction. Alternative 4 would provide complete three-dimensional containment of the waste material, thus eliminating human health and environmental risks. Contaminated solid media would, however, remain on site indefinitely, with the potential for future release. Alternative 4 would require approximately five years to implement, during which time workers would be exposed to moderate health risks. Alternative 5 would afford maximum protection of both the environment and public health since all organic contaminants would be destroyed and the residual inorganic contaminants would be completely contained within a lined landfill on site. However, implementation of this alternative would require about 12 years to complete, during which time site risks would not be fully mitigated and workers would be exposed to moderate health risks.

6.3.8 Community Acceptance

To be addressed after public comment period.

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